THE

ANATOMY OF THE SEASONS,

WEATHER GUIDE BOOK,

AND

PERPETUAL COMPANION TO THE ALMANAC.

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BY P. MURPHY, Esq.

AUTHOR OF THE ASTRONOMICAL WORK, ENTITLED "RUDIMENTS OF THE PRIMARY FORCES OF GRAVITY, MAGNETISM, AND ELECTRICITY, IN THEIR AGENCY ON THE HEAVENLY BODIES."

"Le *Vrai* seul, a des succès durables. Les lauriers dont l'erreur quelque fois se couronne n'ont qu'une verdure ephémere," . . . . "Qu'est ce qu'une science? un enchainement de propositions qui toutes se rapportent à UN PRINCIPE GENERAL ET PREMIER."—*Helvetius.*

"*L'observation*, par la curiosité qu'elle inspire et par les vuides qu'elle laisse, mene à *l'expérience;* l'experience ramene à l'observation, par la même curiosité qui cherche à remplir et à serrer de plus ces vuides: ainsi on peut regarder *l'experience et l'observation comme la suite, et le complément l'une d' l'autre.*—*D'Alembert.*

"*Sans l'expérience, les principes sont chimériques; sans principes, l'expérience est inutile.*"—*Anonyme.*

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DEDICATION.

To the King's Most Excellent Majesty.

Sire,—

In announcing, with its proofs and application, a *new* principle in Astronomy, which being, as assumed, the primary or First Cause, to which, as to their source, both the movements, the temperature, and other phenomena of the heavenly bodies are referable, was the only thing wanted in order to the perfecting of this first of sciences; and, consequently, to the acquisition of which, the aspirations of philosophers have been so long directed: —I considered I should be wanting in that respect and homage which I, Sire, in common with every other member of society in these countries so justly owe to your Majesty,—did I not, on such an occasion, do myself the honour of dedicating this dis-

covery to your Majesty.—The distinctions and honours so liberally—and most justly—conferred by your Majesty's Royal Predecessors, on a Newton, a Herschel, and so many other of the eminent contributors to science,—having, as it were, *entailed* its encouragement and protection, as a sacred trust on their Royal Successors.

Animated by these sentiments, and under the impression that, however deficient in other respects, the object of my work may prove a passport to your Majesty's protection;—as the humblest of the votaries of science,—I do myself the honour, Sire,—with the most dutiful homage and profound respect,—to inscribe this volume, containing particulars of my discovery, to your Majesty.

I remain,

With the profoundest veneration,

Sire,

Your Majesty's most faithful subject

And dutiful servant,

THE AUTHOR.

PREFACE.

The intimate connexion of meteorology with astronomy—amounting as it does so nearly to an identity,—combined with the present theory being, as refers to both sciences, founded on a new and original principle, has compelled me, in order to show the application of this principle equally to both, to recur, in the first place, to its connexion with astronomical phenomena: and—as being agreeable to the order of their relations in nature—thence to trace this principle in its bearings and connexion with the more difficult science of meteorology. This has obliged me to divide the subjects treated of in the present volume into separate classes,—astronomical and meteorological:—commencing with the first; and, as being the chief object proposed,—thence proceeding to the investigation of the latter. Further,—from the lunar

action being assumed the chief *guide* to the ordinary variations and changes of the weather; and that, from its effects on the atmosphere being in great part regulated throughout the year by the existing action at the time in the annual circle:—in order to show the place the lunar action holds in meteorology, it became necessary, in reference to this science, to commence by an analysis of the opposite actions—*solar* and *planetary*—and also of the other concurrent causes connected with the annual circle,—constituting, as these causes do, the *bases* of the lunar action on the atmosphere and weather. This, necessarily, induced a further division in the part of the work which treats more particularly of meteorology:—for, in order to make the lunar action available as *a guide to the weather*,—such an analysis of the ground which, as stated, determines its effects on the atmosphere, became indispensable.

These observations I consider necessary in this place, in order to show the necessity which existed for introducing into the present work this division and distribution of the subjects treated of, that by

pointing them out to the reader he may be enabled to refer at once to the part of the work he may feel disposed to examine or consult. Thus, as regards Astronomy, the reader is referred, chiefly to the "Introductory Observations;"—as refers to Meteorology,—to that part more particularly, which treats of the "Annual and Local Circles;—as refers to the work in its capacity of a "Weather Guide Book,"—to the part which treats of the "Lunar Circle:"—and, as being common to, and connected with each of these divisions,—to the "General Observations," at the conclusion of the volume.

I may add, that, as the first grand division of meteorology appertains to the seasons; and its second to the weather;—and that, as the former are governed by the actions in the annual circle,—the variations in the weather are equally governed and determined in the periods of their occurrence by the lunar action;—it follows, as a consequence, that the lunar action—when understood,—will always be found the most unerring guide to the weather. But the intimate dependence of this action in reference to its effects,—on its sustaining ground in

the annual circle, is such, that the circumstances of *time* and *place* are, and must always be taken into account, as among the most important elements in arriving at a perfect knowledge of the lunar action on the weather. And thence—at once—owing to the nature and the complexity of the subject,—the necessity which must always exist of uniting *particular observation* to a general knowledge of the meteorological principles of our theory; in order to make these principles as available, as it is possible to make them, to the various objects of utility to which they are referable. In this way only, it is, that the present volume—as a Weather Guide Book—will be found fully to answer its object; but which, by means of uniting particular observation to a knowledge of its principles, it will be found most fully to do: and thence will become one of the most useful, if not the most interesting of companions.

Technicalities, being at once common and necessary to each of the arts and sciences,—it was impossible, in a new theory like this, entirely to avoid them:—they have, however, been limited as much as the nature of the subjects would admit of.

And, by way of explanation of a term frequently used,—as *electric action* in the atmosphere is never altogether detached from *magnetic action;* and consequently that the action of either force as refers to the atmosphere and its phenomena is not a separate,—but from its being so connected with the other,—a combined, or *mixed action:* and that, as where in the following pages the term *electric action* occurs, that of *meteoric action* might with equal—if not greater—propriety be substituted;—thence it is that I wish the term electric action, whenever it occurs, to be considered as strictly synonymous with that of meteoric action.

TO THE READER

READER!—To whatever branch or department of society you may belong,—provided that, either from considerations of health, pleasure, curiosity, interest, or all these together,—a foreknowledge of the approaching seasons and changes of the weather be desirable to you; and that, after your acquisition of the present volume, you allow yourself to be *surprised* by the seasons or weather,—I shall only say to you as was said to the boy with his Plutarch, "Read your Guide-Book:"—and should the same circumstance happen to you a second time,—again I say to you, "Read and *understand* your Guide-Book;"—as, at whatever period of the year, or in whatever latitude or species of locality you may chance to be,—by attending to this Guide-Book, few changes of consequence can

occur, in reference to the approaching seasons or weather, for which the principles and details of our theory, as here presented, will not prepare you in advance; thus enabling you to contemplate the dispositions and mighty machinery of Nature, as developed in the passing atmospheric phenomena of the day, with other eyes—if I may be allowed the expression—than those you have been accustomed to.—And, though some philosophers may allow themselves to be arrested at the porch, in discussing and doubting its principles; let this, I say, not prevent your entering the Temple itself, as a true follower of truth; and enjoying, as you journey on the *annual circle*, the pleasure and advantages of which you will shortly be sensible it is capable of yielding you such abundant returns.—Insomuch that, I doubt not, a reference to your "Weather Guide-Book," will, from its tried utility, shortly become as indispensable to you as your timepiece.

P. M.

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ERRATA.

Page 28, line 16, for "othen,"—read *other*.
48, line 7, for "their,"—read *the*.
83, line 27, for "increasing,"—read *increase*.
131, line 2, for "local,"—read *lunar*.
142, line 16, for "Seasons,"—read *Season*.
192, line 4, for "of winter solstice,"—read *of the winter solstice*.
219, line 6, for "article,"—read *paragraph*.
238, line 24, for "contracts,"—read *contrasts*.
327, line 19, for "excepting,"—read *expecting*.

INTRODUCTORY OBSERVATIONS

To the Anatomy of the Seasons, &c.

Of the various subjects which, from age to age, have the most generally engrossed public attention, *the weather*, perhaps, may be fairly set down as holding the first or most conspicuous place. This will not surprise when we take into account the innumerable points of contact which are continually forming between the changes of the weather and the interests of the totality of mankind; insomuch, that from the languid invalid sighing for the balmy and genial warmth of a southern sky, or the agriculturalist or monopolist speculating on the nature of the approaching seasons, to the mariner, whose prospects and life are so frequently compromised by the weather;—the attention of all classes may be said to be more or less habitually, or, as it were, intuitively directed to this subject. And, as the demand usually creates the commodity, thus the so general desire of mankind to pry into the nature of the approaching seasons and changes of the weather has not failed, as might be expected, to encourage speculation, from an early period,

in ministering to the demands of public credulity And with what degree of success such speculations have been got up and continued, not certainly as regards the predictions thus annually put forth, but as refers to *the profits* thence derived, we shall hear what M. Le Comte d'Oxenstirn, a writer of the early part of last century, and a popular work of the present day, say on the subject. The first, in his interesting work entitled *Pensées Diverses*, tom. ii. p. 163, speaking of the former, as contrasted with the state of astronomy in his time, the little attention due to the predictions of the weather published in the almanacs, and the general discredit into which these predictions had brought a science formerly so much esteemed, thus proceeds, by way of illustration, to recount the following anecdote :—" Je me souviens à cette occasion d'avoir oui-dire qu'un homme qui demeuroit dans une certaine ville d'Allemagne, à qui la nécessité avoit apris à faire des almanacs, quoiqu' il *ne sût lire, ni écrire*, s'étant fait lire l'almanac nouveau qui venoit de paroître, il en fit, avec le secours de quelqu' ecrivain, imprimer un autre *tout contraire* à ce que le premier pronostiquoit, et *réussit*. Ses almanacs le mirent bientôt en tell réputation dans le pais d'alentour, qu'il gagna dequoi vivre commodément. Voilà comment la vérité s'attrape en riant, et comment le mensonge passe pour vérité par la prévention des gens." So much in regard to the facility

with which imposture in this way obtained currency formerly, and of the inducement held out to the practice of it. And in turning from the period of comparative *darkness*, which called forth these observations, and which might be pleaded in mitigation of the extreme credulity noticed, to the enlightened age and country in which we live, let us hear what the writer in the publication alluded to, the *Penny Magazine* of June, 1832, p. 95, says on this subject. "Man is so dependent upon the weather, not only for his comfort, but even for his subsistence, that to be able to ascertain its coming changes has naturally always been to him an object of extreme solicitude. When we are very desirous to attain any end, we are easily deluded in reaching it. The weather is one of the subjects upon which the credulity of mankind, thus excited, has in every age been taken plentiful advantage of; and, indeed, it seems to be one of all others over which superstition and imposture have succeeded in establishing the widest and firmest domination. We have outlived most of the other fond beliefs of more ignorant times; .... but the prognostications of the same vain science which are published every year on the subject of the weather, continue to be not only bought but believed, almost as much as they were in the darkest ages, by hundreds of thousands, even in our own comparatively enlightened England. Moore's Alamanac *still sells a quarter of a million of copies.*"

Thus we have it from a source whose authenticity will not be questioned, that public credulity on the score of these predictions, instead of receiving, as might be expected, any commensurate check from the growing lights of the age, is, on the contrary, still as ripe and flourishing in England as perhaps at any former period, or as its warmest admirers could wish; and this even so long after these predictions have been set down by all rational men as pure inventions. And if, in turning our attention from these would-be guides to the weather, published in *Moore's, Nostrodamus,* and *Mathieu Läensberg's* almanacs, &c., to that supplied by *Herschel's Tables*, which, from the name of their author, one would suppose were entitled to a greater degree of deference, we shall find ourselves as much at sea as before; these tables, as *weather guides*, being to the full as defective as the former, a fact which any one in the habit of cosultĩng them will be free to admit; for instance, in the beginning of February 1832, being in Ireland, a report was current there, taken from these tables, that we were to have *a fall of snow* on the 11th (I think) of the month; but the 11th and each succeeding day of the month passed over without any appearance of snow; and so generally in regard to other similar predictions of these tables, thus sbowing how wide the difference may be between the science of *increasing the power of telescopes,* and that of analysing with

accuracy the sources of atmospheric phenomena. But it were no better than a waste of time to dwell longer in pointing out the impossibility of any such guide being efficient which neither does nor can, on just principles, account for the important part exercised throughout the year by the lunar action on the weather, still more than on the tides. Indeed the French writers on meteorology, equally as the more eminent of our own, freely own, as the following extracts will prove, the little that with certainty is known in reference to the principles which influence the weather, admitting that any thing which has as yet been advanced on the subject is no better than conjecture. And thus that, in the absence of all recognized or established principles, meteorology can hardly be said to have as yet attained to the rank of a science.

In the elaborate and excellent treatise on meteorology, to be found in the *Encylopédie Portative*, Paris, 1830, having in a *first part* of the work detailed all that science and observation has brought to light, in reference to the atmosphere and its phenomena: at the opening of the *second part*, which treats of "des instrumens, des signes, et des observations météorologiques," the writer, M. Bailly de Merlieux, expresses himself as follows:—" L'exposé que nous venons de faire de la science météorologique a fait voir combien ses applications sont nombreuses; il à montré aussi, dans bien des cir-

constances, *l'incertitude de ses principes et le peu de secours de ses théories*, non pas pour l'explication des phénomènes, mais *pour la prevision des cas donnés dans lesquels ils doivent se produire. Cette partie de la science est donc encore presque entiérement empirique*, et, malgré le puissant secours que nous tirons des instrumens, les observations peuvent seules maintenant nous guider dans la recherche de ces résultats pratiques." Here is a candid admission in a work so generally looked up to as an authority, as to the insufficiency of existing theories of meteorology, and that the part of the science which pretends to foretel the approaching changes of the weather, is still almost wholly empirical. And, in referring to a still more recent authority already cited, viz. the *Penny Magazine* for June 1832, page 95, from which the former extracts are taken; the writer, in this article, after noticing the great circulation of Moore's Almanac, gives the following observations on the weather:—"The weather is but another name for the state of the air as to heat or cold, dryness or humidity, rest or moisture, and perhaps one or two other similar particulars. The causes, therefore, which influence the condition of the air in these respects are those that occasion the variations of the weather; and these variations cannot be foretold, unless we could calculate and measure the exact force of all those influencing causes. There is plainly

no other way of arriving at the knowledge in question. To pretend to divine it, as the almanac makers affect to do, from the movements of one or two particular stars, is as idle as it would be to attempt to discover what wind should blow on a certain day in December by the motion of a bit of straw or paper thrown up into the air in the preceding January." And again: "Even the most accomplished science in truth has as yet made comparatively but very little way into this most difficult subject. The principal properties of the air, both chemical and mechanical, have indeed been ascertained. The apparently simple element has been separated into its two component ingredients of nitrogen and oxygen. Its weight has been taken; its elasticity, or capability of compression and expansion, has been measured; instruments have been invented for detecting the quantity of heat, or of moisture, or of electricity, with which it may at any particular moment be charged; but the knowledge of all these different circumstances and properties enable us to do but little in predicting the coming changes of the weather." Ay, that's the rub! In these extracts we have not only a summary of what to the present has been achieved in reference to our acquaintance with the atmosphere, but of the difficulties almost insurmountable with which the most important circumstance connected with it is beset, viz. that of ascertaining in advance the approaching

changes of the weather. And thus, notwithstanding all that has been attempted in order to extend our knowledge of this science, that meteorology is still what it has always been, a species of blank in the list of the sciences, of which nothing is with any certainty known; and consequently, that if a change in this respect be at length found practicable, it is not before the wants, the interests, and suffrages of mankind imperiously demand it.

Now, a slight consideration of the subject will be sufficient to show that this imperfect state of meteorology can only have its source *in the imperfect state of astronomy,* however much, generally, and long received opinion to the contrary may tend to mask and conceal the fact from us; for so intimate, it may be observed, is the connexion between these sciences, that without a previous knowledge of the true principles of astronomy, any attempts, however ably planned, or judiciously conducted, which had for object to improve our knowledge of meteorology, could, as regarded the future, be attended with no better success than what has attended similar attempts during the past. The reason of this is very simple;—for unless there be a strict correspondence subsisting between principles and the facts to which they refer, a want of conformity will shortly become apparent, and betray the unsoundness of the former; and thus it is with meteorology. For, as the forces which preside over the atmosphere

and its phenomena are assumed to be the same on which the relative dispositions, the evolutions, and very existence of the heavenly bodies may be said to depend; before having arrived at a knowledge of these forces, and of the principles and laws which govern them in their connexion with the latter, the by far more difficult task of tracing their relations with, and the manner of, their development on the the atmosphere and its phenomena, could never have been effected. From this it will appear that a knowledge of meteorology necessarily implies a previous knowledge of the true system of the world. And thus, as the present theory of meteorology is assumed to be one of the leading and most important results derived from the knowledge of correct astronomical data, some observations on the present state of astronomy cannot well be considered as a digression from our subject.

"Dieu, l'homme, et la nature,—voilà," observes M. d'Alembert, "les trois grands objets de l'étude du philosophe." And elsewhere, "Tous les êtres, et par conséquent tous les objets de nos connoissances, ont entre eux une liaison qui nous échappe; nous ne devinons dans la grande énigme du monde que quelques syllabes dont nous ne pouvons former un sens. Si les vérités présentoient à notre esprit une suite non interrompue, il n'y auroit point d'élémens à faire, tout se réduiroit *à une vérité unique* dont les autres vérités ne

seroient que des traductions différentes. Les sciences seroient alors un labyrinthe immense, mais sans mystère, dont l'intelligence suprême embrasseroit le détours d'un coup d'œil, et dont nous tiendrions le fil. Mais ce guide, si nécessaire, nous manque; en mille endroits la chaine des vérités est rompue; ce n'est qu'à force de soins, de tentatives, d'écarts même que nous pouvons en saisir les branches: quelques unes sont unies entr'elles, et forment comme différens rameaux qui aboutissent à un même point, quelques autres isolées, et comme flottantes, représentent les vérités qui ne tiennent à aucune." Such are the ideas of this truly great man and profound observer as to the necessity which exists, in the first place, of ascending to original principles,—of attaining to the knowledge of some fundamental truth or truths in physics to which the others are subordinate; and from which, consequently, as branches from a trunk, the latter, with their families of derivatives, necessarily extend and develop themselves. But, as elsewhere observed by M. d'Alembert, "Telle est la fatalité attachée à l'esprit humain, que moins un sujet l'intéresse, plus il trouve presque toujours de facilité pour le connoître; et cela est si vrai, que dans l'étude même de la nature, *les premiers principes*, dont il nous importeroit le plus d'être instruits, sont *absolument cachés* pour nous." From the absence of such original truth or truths, and the utter impossibility

from the then state of chemical and electrical science of attaining to the knowledge of them,—and not, as the subjoined extracts from his writings will show, from his ignorance or want of conviction as to their importance, was the illustrious Newton obliged, as he expresses it, "to argue from phenomena without feigning hypotheses, and to deduce causes from effects, till we come to the *very first cause,* which certainly is not mechanical." And elsewhere; "Though every true step made in this philosophy brings us not immediately to the knowledge of the first cause, yet it brings us nearer to it, and is on *that account* highly to be valued:" and this, as is most clearly expressed, in order to arrive at the knowledge of such first cause. An expression, by the by, which appears to be misunderstood by the Rev. W. Whewell in his lately published work on Astronomy and General Physics, as he assumes this *first cause* pointed to by Newton as being intended to mean the Deity, but which there is little reason to doubt was intended by its author simply as applying to the first in the list of *physical* causes. And that this first cause was not discovered by Newton, notwithstanding the opinion so generally entertained to the contrary, without referring to these his own recorded ideas on the subject, the following interrogatory will be sufficient to prove, viz. What and how many are there, in the great family of truths, which the Newtonian principle of universal gravita-

tion either applies to, explains, or can fairly be said to be connected with? Can we, for instance, trace any connexion between this principle and that whence light, and heat, and vitality, equally as movement, are imparted to the "thousand worlds around," and to the myriads of families in the animal and vegetable kingdoms, of which those glorious orbs are the conservatories? We may push our interrogatories still further, and demand, *does such a first cause as this alluded to exist?* And if so, what is this original and fundamental cause whence the entire chain of natural effects in the physical world, whether as connected with the sun and planets, or with their animal and vegetable kingdoms, necessarily depends and develops itself? For if in reality such a first cause exists, as the object of a discovery, according to our friend d'Alembert, "il doit être non-seulement *grand* et *nouveau*, mais encore, *utile*, ou du moins curieux, et de plus *difficile à trouver*," it will hardly be denied that the discovery of this cause is recommended both by its connexion and identity with the entire of the requisites here noticed. "If you have declared the truth," said an old philosopher, "and that they are about to pelt you with stones, withdraw yourself awhile, have patience, and be silent, for truth will finish by being known."—It is now eight years since I announced the discovery which for the first time led inevitably to the knowledge of this *first cause* in

physics, in the paper presented by me in 1826, to the French Institute, on the analogy then lately discovered by me between the lunar action on the tides and temperature; which, as stated, necessarily, and as a matter of course, led to a knowledge of the principle by which this analogy subsists, viz. REFLECTIVE ACTION. This principle, it is true, was not as yet detected, and consequently was not mentioned by me in the paper alluded to. It, however, shortly after was discovered, and was pointed out by me to the Astronomical Society of London in November 1829. But my paper on the subject having been, as I was informed, referred to the committee of the society, was ***returned*** to me by the president, after it had been denied even so much ***as a reading:*** my object in presenting the paper being for the purpose of having it read at the meeting of the society then on the eve of taking place. Such having been the only result of the first ***coup d'essai*** made by me in reference to the announcement of this great discovery to the conservators and ***encouragers*** of astronomical science in England! This conduct on the part of the Astronomical Society of London, however, not being much calculated to produce conviction in my mind, either as to any want of correctness in the principle itself, or of its assumed importance, it constituted the basis of the astronomical work entitled "Rudiments of the Primary Forces of Gravity, Magnetism, and Electri-

city in their agency on the Heavenly Bodies," published by me both in London and Paris in the year 1830. This principle was then, with the publication of this work for the first time submitted to the British and continental public; and it is but fair to add, that notwithstanding some *unbought* encomiums which this work obtained both from a portion of the British and foreign reviewers at the period of its publication, the principle of reflective action itself has not, from that time to the present, had the slightest attention paid to it by the world of science, as will more fully appear in the subsequent pages. Whether, however, this apathy be an effect of what may be denominated the constitutional repugnance which the generality of men feel towards all inroads or alterations in *doctrinal points*, whether in politics, in physics, or religion, however requisite and necessary, I shall not pretend to determine; or, that it be owing to the species of difficulty so generally found by almost all persons in, for the first time, *comprehending* certain truths, however plain and palpable such truths may in the end appear to them, but more particularly those connected with astronomy and perspective, I shall leave to others to decide. A remarkable instance of this difficulty of comprehension, it will be recollected, occurred in the case of *Caspar Hauser*,—a circumstance, it may be observed, which, were it not so fully and frequently attested, we might well question the reality of. For

it appears, at first, rather singular, that men with their eyes open should be in the habit of regarding certain objects, from age to age, and yet not be able to comprehend distinctly either their true relative positions, proportions, or relations, even though they should be pointed out to them. The fact, however, is too notorious to admit of doubt. And to this it is, or to incredulity, or what you will, that is to be ascribed the fate which has hitherto attended the announcement of the principle of *reflective action,* which, though so long publicly announced as being the principle on which the unity, the dispositions, movements, temperature,—in a word, the cohesion, whether individual or collective, and what may be denominated the vitality of the heavenly bodies, together with that of their worlds of being, is based; yet has it not to the present been able to attract, even in the most distant way, public attention to it. And, it may be added, amongst the few who have directed their attention to the subject, still fewer have fully comprehended its meaning, or its importance as a discovery.

What then, it may be asked, is *reflective action?* The question to some may seem superfluous, from its simplicity; however, as in natural phenomena, what appears to be the most simple, is found to be, not unfrequently, if not the most complex, at least the most difficult fully to decipher. Let us therefore not allow the seeming simplicity of what is usually under-

stood by the term reflective action, to prevent us from inquiring a little more minutely into its nature. And the shortest way to arrive at a correct idea of what is meant by the term reflective action, will, in the first place be, by an examination of the operation whence the term is derived. The most simple and palpable illustration of reflective action, perhaps, is that supplied us by the *mirror,* in representing and imparting to the understanding of the observer, through the medium of his visual organs, the exact imagery of objects placed before it; but, be it observed, only through this the medium of *the visual organs.* The latter circumstance necessarily leads us to the further inquiry, as to the nature of the sense of vision? The sense of vision, in its connexion with the mind, has been compared, and justly, to the species of intelligence of an object which is conveyed to the mind of a blind man, by means of a *rod* extending from his hand to the object indicated; or, in a word, to a species of collision and *touch,* imparted by the object seen, to the retina of the eye of the observer, through the instrumentality of the intervening medium of light, and thence conveyed to the understanding. And by extending still further our inquiry, and demanding in what consists the sense of taste, of hearing, and of smelling, as well as those of seeing and feeling, we shall find that the former, equally as the latter, are no more than varieties springing from one common

source, viz. of sensation imparted to the mind through the instrumentality of *collision* with the organs of the body. The only difference being, that each of these sensations is imparted through a particular organ incorporated in the animal structure adapted thereto; each sense being literally a particular door, or passage of communication to the understanding, effected through the medium of collision or *touch;* and sensation, thence, in each case, the effect of a *reflective action* in the particular organ imparting it. And if in pushing our analogy still farther, and applying it to what Bacon and other philosophers have denominated the *sixth* sense in animals, viz. *love;* and which, likewise, is more analogous to our subject, as being that in which the entire of the other senses are laid, as it were, under contribution; we shall find that its effects result, perhaps, more than those of any particular sense, from *reflective* or sympathetic action. And my object in introducing this seeming digression has been, in order to show the variety of routes by which, as by *actual collision,* nature has contrived to make bodies, however removed and apparently distant one from the other, act both palpably and physically on each other, through the instrumentality of *reflective action.* And were it not that dilating further on the intelligence capable of being conveyed to the mind through the medium of reflective action might be thought superfluous, there are some things connected

with the constitution and habits of certain animals, as refers to the intelligence—more than human—which, under certain circumstances they display, and which in any other way cannot be explained, that can be satisfactorily accounted for on this principle; as nature is not restricted to the number of inlets to the mind, with which she has thought fit to endow mankind, *e tanto basti*, &c. in that direction. But to resume. The nature of reflective action, as connected with astronomy, cannot so well be understood, without some previous reference to the subject of inquiry, and demanding,—*what is matter itself*, or *its properties*, as connected with astronomy and physics? And, ere entering on the latter part of the inquiry;—the first circumstance observable in reference to matter, in the form it assumes in the natural world, is, that of its divisibility into opposite kinds, i. e. *solid*, and aeriform or *gaseous*. Owing to which divisibility of matter, it is that, as at present is generally admitted,—neither blank nor chasm occurs in the solar system; the spaces therein which are not occupied by the masses of the sun and planets, or the *solid* portion of its matter, being completely filled up by the opposite or *aeriform* species of matter connected with these bodies. But this, as we may perceive, is not the only division introduced by nature into the matter of which the solar system is composed, as besides being divided into solid and aeriform, it is further divided

into *opposite species*, i. e. *solar* and *planetary*. And as the solid matter of which the sun and planets is composed is of opposite species, so likewise the gaseous or aeriform matter connected with these bodies, and partaking of their nature is of *opposite species*. But as the aeriform matter of the sun on the planets, or on itself, can only act by its *touch* or contact with the superficies of these bodies, and that, on the same principle, the aeriform matter of the planets, whether on each other, or on the sun, can only act by its contact with their superficies; thus it is that the action of these bodies, whether on themselves or on each other, both is and can only be through the instrumentality of this universally extended aeriform medium, or gaseous moiety of their matter, by which they are on every side surrounded and connected. And further, as regards the action of these bodies on each other, separated as they are by such vast intervals, it can only subsist by means of the open and direct *exposition* of the parts of the superficies of *the bodies acted on*, to the presence of the distant masses of *the bodies acting:* or similar to light and vision, by its being unchecked and uninterrupted in these the intermediate spaces by which they are separated, and consequently only from and by means of such action being *reflected* by the superficies of the bodies acted on. This, it is hoped, will serve to convey a correct idea and definition of the term *reflective action*,

in astronomy, as recognized by our theory. Thus, for instance, it is only by its being reflected by the eastern hemisphere of the earth, that the solar action, through the medium and instrumentality of this its aeriform matter, produces its effects on our atmosphere, of light and heat by day; and, at the same period, on its opposite or western hemisphere, from its being exposed thereto, the opposite action of the moon and external planets, similarly induces their effects on the atmosphere by night, simply by reason of this their action being reflected by its superficies. And as the mass of the sun equally reflects the action of the planets, as the masses of the planets reflect the action of the sun, and of each other; so the same division of these actions equally subsists between the opposite sides or hemispheres of the entire of the remainder of the planets, as between those of the earth; and their movement of rotation, by continually inducing changes in the sites of either action on their superfices, as both cannot subsist together, has the effect of preventing either from inducing extreme effects on their atmospheres; so that from its being external, and the whole of these bodies being continually exposed thereto,—thus no interruption occurs, or, with the exception of those caused by eclipses, can occur, in this the reflective action of these bodies on each other.

Thus far in reference to the existence of a reflective action between the bodies which compose the

solar system, and the medium and manner of its existence. But the circumstances which render this action at once the conservative basis, as well as the source of the order, harmony, movement, and vitality which we see subsisting throughout those bodies, remain to be noticed.

The doctrine of "universal gravitation," similar to that of "final causes," by which it was preceded, having, as referred to physics, had its season of trial, and, the latter having proved *barren*, it was time, unless all further investigation or advance in this department of science were to be given up as hopeless, to strike into and examine some other route by which a more correct and intimate acquaintance with the laws of nature, as connected with astronomy and physics might be obtained. Sir Richard Phillips, in his excellent work entitled "Dialogues, &c." published in 1824, as well as others, among whom may be mentioned M. d'Alembert, had shown the futility of the Newtonian theory; but being unprepared to substitute any thing more probable in its place,* their ideas, however well founded, were either looked on with indifference, or with contempt; and they consequently produced little or no *disturbing* effect. And thus, like some other things which fall out in the world, the doctrine of universal gravitation,

* Quand il eut lu le second volume, *il ne fut plus si content,* et il conclut *qu'il est plus aisé de détruire que debâtir.*"—*L'Ingenu.* par *M. Voltaire.*

for want of a better, was allowed to continue its course of ascendency. More, it may be observed, from respect for the great man with whom its application to astronomy originated, than from any conviction which it was calculated to produce on the minds of those who maintained it. For, as to any necessity which existed for the doctrine of universal gravitation in calculating the movements of the heavenly bodies, after the discoveries of Kepler, in reference to the laws of movement had been made, no such necessity in any way existed. In proof of this, let us hear what M. d'Alembert says on the subject, in treating of the three fundamental principles of mechanics, viz. " la force d'inertie, du movement composé, and de l'équilibre." " A l'égard des démonstrations de ces principes en eux-mêmes, le plan qu'on doit suivre pour leur donner toute la clarté et la simplicité dont elles sont susceptibles est de les deduire toujours de la considération seule du mouvement envisagé de la maniere la plus simple and la plus claire. Tout ce que nous voyons bien distinctement dans le mouvement d'un corps, comme nous l'avons déjà dit ailleurs, c'est qu' il parcourt un certain espace, et qu' il emploie un certain tems à le parcourir. C'est donc de cette seule idée qu' on doit tirer tous les principes de la méchanique, quand on veut les démontrer d'une maniere nette et précise ; en conséquence de cette refléxion, le philosophe doit, pour ainsi dire, détour-

ner la vue de dessus les *causes motrices,* pour n'envisager uniquement que le mouvement qu'elles produisent ; il doit surtout *entièrement proscrire les forces inhérentes au corps en mouvement, êtres obscurs et métaphysiques, qui ne sont capables que de repandre les ténèbres sur une science claire par ellemême.*"* Such are the recorded ideas of this great mathematician, not only as to the total inutility, but as to the injurious effects, of allowing the principle of inherent or latent causes in bodies to enter into or interfere with calculations of their movements. And as to the opinion entertained by the great philosopher, with whom the doctrine of universal gravitation is identified, in regard to the extent of his discoveries in physics, as compared with those which he was too clear sighted not to see, still remained to be made in this grand department of science. Let us hear what he himself says on this subject, as related by his biographer, Dr. Brewster. "A short time before the death of Sir Isaac Newton," observes the Doctor, "he uttered this memorable sentiment—"I do not know what I may appear to the world, but to myself, I seem to have been only like to a boy playing on the sea shore, and diverting myself in now and then finding a smoother pebble, or a prettier shell than ordinary, *whilst the great ocean of truth lay all undiscovered before me;*"

* Voyez, "Melanges de Littérature, &c." par M. d'Alembert. Tome iv. p. 202 and 203.

an admission in all respects worthy of Newton, but which, it may be added, his followers appear altogether to overlook in their zeal, and the superstitious veneration in which they appear to hold his principles; as though they esteemed it as something sacrilegious to doubt or call in question, any point touched on by this truly great man. "Tout se fait dans la nature," we are told, "*par des degrés insensibles.*" And a slight examination of the subject will show that, however lavish in the mental endowments with which she favoured this extraordinary man, nature had made no exception in the case of Newton. For the history of his time, as indeed, that of science in general, would prove that, similar to the advancing tide, in reaching *the same levels* at the same periods of time, however widely distant and separated from each other; so, in more instances than one, the same discoveries were progressing at or about the same periods of time, in places widely detached from each other, and without the parties making them being at all aware of the circumstance. Thus it was in reference to the differential system of calculation in geometry, the honour of the discovery of which led to the famous dispute betwen the partizans of Leibniz and Newton, which in 1715 ran so high as to assume the appearance of a national quarrel.* The discovery being supposed

* Thrice, and ever-to-be-accounted, happy times in the annals of science!—how are you changed. For when, it may be asked,

to have been made about the same time by both, but without either being aware of the fact, as regarded the other. So likewise, at a still later period, in reference to the discoveries in electricity, made by Franklin in America, and the Abbé Nollet and M. de Romas in France, each party claiming the honour of *priority*. From all which it will appear, that however great and extraordinary were the discoveries of Sir Isaac Newton, there was nothing supernatural in them, or beyond what lay within the ordinary province of the human understanding to effect, at the time in which he lived; that is to say, in such of them as were *real*. And that without the aid of further discoveries, which were reserved for his successors, it was altogether impossible for this great man to arrive at true notions in reference to the number and nature of the primary forces and fundamental laws, by which the great spectacle of nature in the heavenly bodies is upheld and perpetuated. It will further appear, that the great error of Newton, in reference to the application of his law of universal gravitation, assuming it to have been such; had its source, like most other errors in physics, in hazarding a pace and conjecture *in advance of ascertained facts.* And this was the more difficult to detect, as, *individually*

are its votaries destined again to witness their labours thus honoured, with being made the subject of contention between rival states?

considered, his assumption appeared to be, both conformable to fact, and, as related to the movement of the planets, borne out by experience. But, similar to all things connected with astronomy, in which the relations are at once local or individual, and *collective*;—he appears not to have taken into account, that unless considered under the latter, as well as under the former point of view, it could lead only to erroneous conclusions in this science; that is to say, unless gravity were considered not only in its relations with the other bodies of the solar system equally as with the earth, but likewise in its relations with *the other primary forces of nature* in these bodies; (which, at that period, be it observed, were hardly so much as known,) all ideas in reference to this force, as applied to astronomy, could not have been other than erroneous. This action of gravity, as I hope to show, not being in any respect a detached or *isolated* action, but one connected with and forming part and parcel of that common mean of action on the elements of these bodies, which in each is derived, from its union with the other active forces of nature in them respectively; and which is, in all other respects, regulated thereby. Thus, it will be seen, how little they honour the memory of Newton, who (as some would seem disposed,) would proscribe any further investigation of astronomical principles, as being superfluous, under the impression that they were brought

to a close by his labours;—while the immense chasms still observable in this science so loudly proclaim the contrary! And, at the same time, that we honour the shade of this illustrious ornament of his country, and benefactor of mankind; which, be it observed, we cannot do more effectually than by prosecuting, to the utmost degree of possible perfection, the great work by him begun; let us not, through servility or false ideas of respect for every thing which bears his name, either close our eyes, or tie up our hands, so as to prevent us from attempting what still remains to be effected in this grand department of science. For, it may be asked, are the sticklers for the doctrine of universal gravitation aware, that, as was observed of Descartes, could the great Newton be called back to life in our days, he would, from the discoveries effected since his time, (in reference to the forces and laws of nature as connected with the heavenly bodies,) be, himself, perhaps, the first to recognize the errors, and condemn the system which bears his name? But to resume.—In reference to the doctrine of first causes in astronomy;—in the theory of this science, published by me in 1830, in my work already alluded to, the following were amongst the leading assumptions, viz. The sun and planets are to be considered as the union, or mysterious incorporation of the elements of *three* primary forces, of whose agency the appearance, and movements, &c. of these

bodies are esteemed as being the harmonious expression. That these primary forces are *gravity*, *magnetism*, and *electricity*. That each of these forces is *collective* or universal, as well as particular or local, in its action on the sun and planets, and that, to the ever-active agency of these forces in the solar system, the union of its parts, and the individual cohesion of the elements of its members depends; and to it their relative positions, their movements, *orbital* and *rotatory*;—their temperature, and, in a word, the entire of their local phenomena are, as to their true source, to be ascribed. Moreover, an active *sympathy* and mutual dependence subsists between the different bodies which compose the solar system, causing thereby, that none of them can, strictly speaking, be considered othen than relatively *detached*; and thus that, collectively, they constitute *a whole*, the different members of which are essential to each other; insomuch that any one of these bodies could not be detached from the system, without inducing effects more or less injurious to the remainder. And owing to which principle of active sympathy and mutual dependence between these bodies it is, that the planets are assumed to exercise, reciprocally, an important influence on certain of their local phenomena. This principle of active sympathy between the bodies which compose the solar system, has its source in the circumstance, that the whole of these bodies, including the sun,

are composed of *homogeneous* elements; the difference between the sun and planets being esteemed to consist in their being of opposite species, or *sexual*:—a solar principle to a certain extent existing in the planets, and a planetary principle, to a certain extent, in the sun. The medium and conductor by means of which this sympathy is imparted, and this mutual dependence subsists between the sun and the planets, as between the planets and the sun, and each other, is a gaseous aeriform fluid or atmosphere, having its source in the sun and planets, and extending to the extreme superficies of the solar system, filling and occupying the whole of the regions of space in which these bodies revolve; and, consequently, the existence of a *vacuum* in the solar system is considered as impossible. And as this mutual sympathy and dependence between these bodies, is assumed to have its source in the action of these the primary forces of nature inherent in them, the medium of this action is the aeriform fluid or atmosphere by which they are surrounded and connected.—Each of the three primary forces is *twofold*, or divided into *opposite species, solar* and *planetary*;—the source of the former being in the sun; of the latter, in the planets collectively. But here a very remarkable distinction in the disposition of these forces is observable; for whereas the primary forces of magnetism and electricity in the sun and planets, are each locally divided into

opposite species, as stated, this division in the primary force of gravity is not as the others, *local;* but subsists between these bodies, only in their collective capacity, as members of the same system, or whole. That, as the action of each of the three primary forces on the bodies which compose the solar system, is at once *collective*, as regards the system, and *local,* as regards each body;—a primary law in the action of each force on these bodies, as of its opposite species, whether local or collective, is, that it *converges* to a particular point or *focus,* where the degree or intensity of its action is, necessarily, greatest. That as the division already noticed of each of the three primary forces into *opposite species,* necessarily causes each species to act *in a direction* opposite to, and *quite different* from the opposite action of the same species, this causes the action of each species of the three primary forces, whether locally in the sun and planets, or as connected with the system itself, of which they are the members, to have a *direction* peculiar to itself, and different from the others. And whereas the main foci to which the opposite species of the primary forces of gravity and magnetism in the sun and planets converge, are permanently fixed and unchangeable; the main foci to which the opposite species of the primary electrical force in these bodies converge, change their local positions at particular periods. The only one of the three primary forces whose action, whether

on the sun or planets, is not *locally divisible* into opposite species, is *Gravity*, and consequently, whose *opposite main foci*, as connected with the bodies, *are not local*, but opposed to each other in each two or more of them, and thence solely as they are connected with the system to which they belong,—from which these main foci of the latter force in these bodies, are called *centres of gravity*. To this division of the primary force of gravity in the solar system into opposite species, it is, that not only the local union and cohesion of the elements, both solid and aeriform, of which these bodies are respectively composed, but also the principle of their mutual conservation, in not impinging or coming into collision with each other in their movements; and likewise the relative position they hold in the system, must be attributed.

This, the *repulsive action* of these bodies on each other, which results from this disposition of the primary force of gravity in the solar system, in being divisible into opposite species, as connected with the sun and planets, being at once the source of their collective security, and of the invariable harmony which eternally reigns between them in their orbits;—that thence, as the operation of this the *repulsive* action of the sun on the planets, as of the latter on the sun and on each other, were it not checked by the presence of a *different action*, could only be to elongate and remove these bodies con-

tinually farther from each other:—any other movement than that of thus projecting them, could not be induced by this distribution of the force of gravity between the sun and planets; and consequently we are not to look for their movements in the action of this force. But as the action of gravity on the heavenly bodies is combined with that of *magnetism;* and that magnetic action, both in the sun and planets, is locally divisible, as in the earth, into *opposite species,* diverging to opposite main foci situated at their poles, and consequently on the lines of their axes: and that, from the force of *attraction* which is known to subsist between magnetic poles of *opposite names,*—a reversal of the magnetic poles of the sun to those of the primary planets, as of those of the latter to the magnetic poles of their satellites, would have the effect of continually drawing these bodies closer to each other, were not their attractive forces in their turn counterbalanced and checked by the force of repulsion incident to the opposite actions of gravity, as already described. Thus it is, as assumed by our theory, that to the local division of the primary magnetic force into opposite species individually in the sun and planets on the lines, and in the direction of their axes, and to the reversal of their magnetic poles of the same name, in the positions these bodies occupy in the ecliptic, coupled with their repulsive agency on each other, that the *elliptical movement* of the hea-

venly bodies is to be ascribed, as will be found more fully treated of in the "Rudiments of the Primary Forces, &c." This primary movement of the planets round the sun, as of the satellites round their primary planets, on which all the variety of their seasons chiefly depends, and on which their movement of rotation is engrafted, being (like some other things observable in the world,) the result of opposite and conflicting actions, *rerum concordia discors!*

Thus we perceive, that through the union and conjoint agency of the primary forces of gravity and magnetism, not only the conservation of the sun and planets, but their orbital movements might subsist and be upheld. But without the addition of another and different movement than the latter, viz. that of their *rotation,* the elliptical movement of the planets, for all purposes of utility, as connected with their vegetable and animal kingdoms, were completely abortive and of no avail. In order, then, to the rotation of the planets on their axes,—to the primary forces of gravity and magnetism in these bodies, it became necessary to superadd another, by whose potent agency not alone the latter movement, but the vital and vivifying phenomena of light, heat, &c., which, in a word, changes them from dark, chaotic masses, to those glorious theatres of life and fecundity we behold them would be induced; and accordingly the primary *electrical* force, the

most active and potent of the forces of nature; and locally divided in the sun and planets, the same as magnetism, into opposite kinds, was added to those of gravity and magnetism. But the addition of the primary electrical force to those of gravity and magnetism, though it might be the means of diffusing light and warmth to the sun and planets, must have closed its agency with the production of these phenomena, had not nature, in adding it to the other primary forces, also given to its action in these bodies a direction adapted to the production of their movement of rotation, and consequently a direction peculiar to itself; for as the direction of the local action of gravity in the earth, and by analogy in the sun and remainder of the planets, is from the superficies to the centre; and that taken by the opposite species of magnetism is horizontal, or from the tropics to the poles; if nature had not imparted a local direction to electric action in these bodies, different from that of the other primary forces, in thus uniting it with them, it could not any more than them become the medium of imparting the movement of their rotation to the sun and planets. Accordingly, we find that this important circumstance has not been overlooked, for in the experiments on the magnet, made with the galvanic wire, i. e. in uniting the electric to the magnetic force, the same as they exist in the atmosphere, a discovery in physics has been made, which, as it was

necessary, in order to prove the existence of this law of electric action, the Rev. W. Whewell, in his excellent work, justly considers it as ranking in importance next to that of the supposed law of universal gravitation, viz. that the action of these forces when united, takes a direction at *right angles* with each other. "The action of a galvanic wire upon a magnet," observes Mr. Whewell, "being not to attract or repel it, but to turn it to the *right* and *left;* to produce motion, not to or from, but *transverse* to the line drawn to the acting particles." Now to make the application of this law of electric action in its union with magnetism, as these forces subsist in the atmosphere. In the collective force of the reflected action of the sun, or *positive* species of electric action, by the entire of the *eastern* hemispheres of the remainder of the planets as by that of the earth, in its production of light and heat in their atmospheres, and in its convergence to a particular point or *main focus* perpendicular to the path of the sun in each, and consequently between their tropics, and in the effect induced by this action of causing, as is the case, a physical *increase of weight* in, and consequent increase of *pressure* by this part of the atmospheres of these bodies on the points of their superficies traversed by these its main foci, combined with the *angle* at which this the maximum effect of this collective action comes into collision with their superficies:—in these circum-

stances, I say, and in this law of electric action of crossing at right angles the axes of the planets, we discover the force of *impulsion*, together with the means and manner whereby it is imparted, and in which their movement of rotation has its source. Similar to the impulse given by the descending stream to the revolving water-wheel, acting continually on the same circles or parts of their superficies, the force of the impulsion so given necessarily induces this movement in each of these bodies, which the change in the position of the impulsion, with the progression of the movement it induces, combined with the invariable sameness in its amount or mean action in each case, continually sustains and perpetuates, without check, interruption, or variation of any kind. Thus we are enabled at once to see and to contemplate both the simplicity and perfection of the disposition by which nature has provided not only for the preservation of the sun and planets, but likewise, as connected with their orbital and rotary movements, for the production of that endless variety incident to the changes of the seasons,—of light and shade, &c., which constitutes one of the greatest charms of existence; leaving, as we see, in these her dispositions, nothing to caprice or chanee; but appropriating to each of the fundamental functions necessary to the conservation, the movements, the temperature, and, in a word, to all things connected with the

permanent well-being of these bodies, a separate and competent agency. And as a proof at once that in her principles of action nature is always conformable to herself and the same; and consequently, that in making the application by analogy of what is within our reach and cognizance in this the planet we inhabit, to the same circumstances and phenomena as refers to the remainder of these bodies; and of the correctness of our assumption, that with the aid solely of the primary forces of gravity and magnetism, both the conservation and orbital movement of the sun and planets might be effected and upheld, we may cite such of the primary planets as are accompanied by satellites; as for instance, *Jupiter*, it being, with the exception of the divisibility of the primary electrical force into opposite species, as in the sun and planets, a perfect minature representation of the solar system: the parent planet, in this case, similar to the sun, exercising the same influence on the relative position and orbital movement of the satellites, as the sun does on this and the remainder of the primary planets. And as nature seems to delight in variety, not only do we find the class of proofs noticed of this invariable sameness in her principles and dispositions of action *in* the solar system itself, but at distances *without it*, compared with which, to use the words of the Rev. W. Whewell, "the orbit of Saturn shrinks to a point." The circumstance

alluded to refers to the observations made by Sir John Herschel, on what are called *double stars,* several of which, as appears, "consist of *a pair* of luminous bodies, which revolve about each other in ellipses, in such a manner as to show that the force by which they are *attracted* to each other varies *according to the law of the inverse square.*"* Here, it will be perceived, we are presented with a disposition of the heavenly bodies in which, in place of a sun accompanied by an assemblage of planets, as in our system, nature has concentrated the opposite or sexual species of her primary forces, similar, if we may be allowed the comparison, to *man* and *wife,* into no more than *two* of these bodies, or one of each species; causing them, simply by the equilibrium existing between their masses and forces, thus to subsist, and perform all the necessary functions incident to their double revolutions round each other, and round their axes, without any other centres of such reciprocal dependence than those originating, and having their source in the opposite poles, or centres of their opposing primary forces. And here it may be right to remark, that the inverse action of the opposite species of the primary force of gravity, in which that of the principle of *repulsion* subsisting between these bodies has its source, acts, and can only act between them, according to the law here noticed, of the *inverse*

* See *Whewell's Astronomy and general Physics,* p. 230.

square. The same law, be it observed, being equally referable to the repulsive action subsisting between the opposite main foci, to which the opposite species of the primary forces of magnetism and electricity in our atmosphere locally extend; these their repulsive forces in each case, similar to the local action of gravity in these bodies, *diminishing in the inverse ratio of the squares of the distances*, as we recede from their opposite main foci in the direction of the central points in the atmosphere from which they diverge.

In proof of the latter, as refers to magnetic action, it may be sufficient to notice the increased prevalence of the aurora *borealis* and *australis*, (they being perhaps more *visibly*, than any other meteor, connected with magnetic action,) as we approach the vicinity of its opposite main foci at the poles; and, as refers to the same law applying to electric action in the atmosphere, identified as this action is with the principle of its *temperature*, it will be sufficient to notice the *falling off* in the amount of *heat by day*, as of *cold by night*, in proportion as at these periods we ascend from the plain, or main foci, of the opposite species of electric action, in which these opposite species of temperature have their source, *at the surfacc of the earth*, i. e. to the upper or middle region of the air, from which these opposite foci diverge vertically to the higher region

of the atmosphere, and in the opposite direction, to the superficies of the earth,—or region of the clouds.

However seemingly perfect such a distribution, application, and general arrangement of the three primary forces of nature connected with the heavenly bodies, as that which it has been here feebly attempted to trace the outline of, might at first sight appear, if it did not combine and comprise within it the element of *equalizing* the action of *each force* in *each* and every member of these bodies, it would still be defective; i. e. in arranging the action of these forces in such way as that a common standard of action in the force of gravity, of magnetism, and of electricity should exist locally throughout these bodies, and consequently a common standard in the *weight* of bodies connected with them, in their *temperature*, &c. And, as the existence of such a common and uniform standard in the collective and separate action of these forces, throughout the whole of the bodies which compose the solar system, is one of the fundamental principles of our theory, it becomes necessary to state briefly in this place the grounds on which it is assumed. "In the machinery of the universe," observe the Rev. W. Whewell, "there is, so far as we know, *no material connection* between the parts which act on each other. In the solar system no part touches or drives another: all

the bodies affect each other *at a distance*, as the magnet affects the needle."* And in this single admission, let it be observed, without troubling ourselves in reference to any other, we have a full and demonstrative proof both as to the shallowness and insufficiency not only of the Newtonian, but of all other systems of astronomy that have either preceded or followed it; pointing out, as this admission does, most forcibly, the *partial*, and consequently imperfect manner in which things connected with this science have been viewed and judged of; for in all such cases, unless the connexion of phenomena, not only with the local but general dispositions of nature in reference to the system itself can be traced and established, as nothing is other than relatively detached in nature; and, as being a consequence of the latter, that all things connected with the heavenly bodies have this double relation and application; such partial views, from not being conformable or proportioned to those required by the nature of the subject,—the principles and assumptions founded thereon, could not be other than doubtful and imperfect. And as, according to this showing, such views of astronomical subjects only as have reference at once to the solar system collectively, and to each of its members separately, can be considered as strictly admissible

* See p. 151 and 152 of Mr. Whewell's work on Astronomy and general Physics.

in iniquiries of this kind; and that such views must necessarily embrace within their range the contemplation of the solar system as one and *indivisible*; and consequently the collective, equally as the local action of the primary forces inherent in the bodies of which it is composed on these bodies collectively and separately, We cannot, I say, under this point of view *separate*, in any case, the action of the primary forces: but at the same time that we admit the principle of the collective agency of the forces inherent in these bodies on each body individually, we likewise admit that of their local union in each, as they act in the planet we inhabit. But the admission of such local union, in the action of the primary forces, necessarily implies that the local action of each force, in each of the heavenly bodies, as in the earth, springs from a common focus, or point of their reunion in each; and consequently that such union can only be referable to one common principle of action, or primary *first cause* on which it depends, and by means whereof these forces act; and which, as the very existence of these bodies is assumed to depend on the united action of these the primary forces on their parts, were this primary cause of their local union removed, it would have the effect of dissolving the frame of nature in these bodies, and by the separation of their elements, would bring back the reign of chaos throughout the regions of space occupied by the solar system. As,

then, we are led to conclude that the primary magnetic and electrical forces in our atmosphere diverge in their opposite directions from a common centre, which centre is that formed by the convergence of the solar action on the entire eastern hemisphere of the earth to its main focus situated between the tropics, and consequently that it has its source in this the solar action being *reflected* by our eastern hemisphere;—a single step thence only remains, viz. that of identifying the main focus, or centre of gravity, with this the main focus of magnetism and electricity as they are assumed to exist in nature; and we shall find that this primary first cause, in which the local union and action of the three primary forces in the sun and planets has its source, is, and can only be that from which we have departed, and to which we are thus constrained to return, viz. REFLECTIVE ACTION. As such a local union in the action of these forces in the sun and planets, combined with the collective agency exercised by these bodies on each other, could only be effected by means of such, and so universal a principle.

It may be added, that in order to make the primary forces the efficient agencies of nature, which, judging from the external harmony observable, whether in the positions or in the movements of the heavenly bodies, notwithstanding the almost inconceivable velocity of the latter,

these their effects bespeak them to be; this their action in the sun and planets, derives, perhaps, its greatest energy from the principle of their *union* in those bodies; it being already assumed, that it is this principle which makes them, as we see, in all respects equal to the enormous task of circling and constraining, with adamantine grasp, and buoyantly wielding the ponderous masses of those astonishing specimens of creative power. In proof of this, may be cited the almost incredible force acquired by the *magnet*, when exposed to the action of the galvanic wire.* And should a means be found by which the force of *gravity* can be brought artificially to act, conjointly with those of electricity and magnetism,—a circumstance, it is to be feared, rendered impossible, from this force not being, like the others, locally *divisible into opposite species*,—it appears extremely probable, that the action of the electrical and magnetic forces would be found greatly augmented thereby. So far, in reference to the assumed union and common identity of action between the three primary forces locally, in the sun and planets. And as to the additional circumstance,

* If from means so limited as those alluded to, effects are produced, such as, if not witnessed, it were difficult to believe; the amount of the magnetic and electrical forces when called into activity by batteries such as those formed by sections of the entire superficies of the sun and planets, (embracing, as they do, the unbroken extent of their exposed hemispheres, collected on their opposite magnetic and electrical poles by the principle of their reflective action on each other,) may readily be conceived!

of a common standard in the conjoint and separate action of these forces, subsisting equally throughout the remainder of those bodies as in the earth; such an equalization, it may be observed, could, in the first place, be brought about only by this, the local union, of these forces in each, as assumed: and, in the second place, by the relative degree in the action of each force, being regulated by *the same principle* as that of the others; and further, by this principle being the same as that in which their local action had its source. And consequently, that if, as assumed, such equalization exists, we must seek the principle of its existence in the same fundamental *first cause*, as that on which the conservation of these bodies is based, viz. *reflective action.* Owing, however, to the double disparity, as regards this the principle of reflection, subsisting between the planets, that is to say, the difference in their distances from the sun, and the difference in their magnitudes; in order to equalize results in the local action of the primary forces throughout the planets, it became necessary to compensate the difference in their distances from the sun, by a difference in their magnitudes; and where the latter, as in the secondary class of these bodies—the satellites—could not be effected, to compensate such difference by the operation of another principle or law, viz. that of a difference in the *times*, or lengths of their exposition to the solar action. And, by comparing the magnitudes of the

planets with their distances from the sun; and the length of their day with that of their magnitudes, as *reflectors;* we shall find that, in proportion as these bodies, including, of course, their satellites, (and as refers to Saturn, his *rings*, whose use as *reflectors*, we are now for the first time taught to appreciate), recede from the sun, and their distances increase, the difference is compensated for in their magnitudes. And that, as in the case of our satellite, where such difference is not in this way compensated for, it is by the principle stated, viz. the increase in the length of their day, or consecutive *exposition* to the solar action; and in such way as not simply to show, but to prove, mathematically, the correctness of our assumptions. This difference in the magnitude of these bodies, and the still more extraordinary difference in the length of the day in the smaller, as contrasted with the larger of the primary planets, as is most strikingly illustrated in the satellites, being strictly conformable to what, according to the principle of *reflective action*, and only to be explained on this principle, should be the case. All these differences, in reference to the opposing principles of *time* and *magnitude*, bearing evidently the impress of opposite but commensurate classes of *equivalents*,—all converging to a common point or centre; viz. that of equalizing the local action of the primary forces throughout the entire of the planets; and, consequently, its results, whether on

their temperature, the action of gravity, &c. &c. It is necessary, however, to observe, that this assumed uniformity of results in the action of the primary forces throughout the planets, is derived from the circumstance, that the required force in the *aerial levers*, which impart to these bodies their movement of rotation, has been made subservient to, and consequently dependent on, the principle of their mean temperature; for as both effects result from the same action, the former, in any individual case, cannot attain to such a degree of force on the point of the superficies of the body where it acts, before the mean temperature of its atmosphere has risen to the same degree as in the others, as may be seen more fully treated of in the *Rudiments of the primary Forces*, &c.

It is, and has long been so admitted, one of the advantages connected with and peculiar to truth, that from whatever side approached, it will still be found conformable and in unison with itself. And, together with all the fundamental points connected with the preceding assumptions being borne out and established by facts, i. e. as refers to the electrical and *local* nature of planetary temperature, this being established by the experiments made with the *Zambonic pile*, as will be found more particularly detailed in my former work; as likewise the orbital and rotary movement of the sun and planets, having their source in the local union, combined with the divi-

sion into opposite species, and the peculiar and *opposite directions* taken by the primary magnetic and electrical forces locally in the atmosphere, in order to their becoming fit instruments for effecting these movements, being established by the experiments made on the magnet with the galvanic wire, as before stated; and, as refers to their local union and vital agency of these forces having their source in the principle of *reflective action*, being established by the analogy subsisting between the lunar action on the tides and temperature. There are, however, still some additional circumstances which it may not be amiss to notice in this place, as being further corroborative not only of these assumptions, but of those connected with the still more abstruse question of the local union, in the sun and planets, of the primary force of gravity with those of magnetism and electricity; of its divisibility, similar to these latter forces, into opposite species, as connected with those bodies,—these its opposite species diverging from *the centres of their equilibrium*, situated in the spaces by which they are separated, to opposite main foci, or centres of gravity, in these bodies. And that to this division of the primary force of gravity into opposite species it is, that we must ascribe the *repulsive* action of the sun on the planets, and also of the latter on each other, by which, in conjunction with the *attraction* subsisting between their magnetic poles, they

are restrained within their respective orbits, and collision or derangement of any kind between them is rendered impossible; and, as our assumption will not be esteemed the less worthy of credit by citing a great authority in its support, we shall, in the first place, show that the *latest* conclusion come to by Sir Isaac Newton in reference to the action of gravity on the sun and planets was, though based on a different principle, altogether conformable to our theory, notwithstanding that from the then state of chemical and electrical science he was totally ignorant of the fundamental law of nature, of dividing, as connected with these bodies, each of her primary forces into *opposite species.* "To show," observes this great man, "that I do not take gravity for an essential property of bodies, I have added one question concerning its cause, choosing to propose it by way of question, because I am not yet satisfied about it for want of experiments." The hypothesis which he thus suggests is, that there is an elastic medium pervading all space, and increasing in elasticity as we proceed from dense bodies outwards; that this "causes the gravity of such dense bodies to each other; every body endeavouring to go from the dense parts of the medium towards the rarer."* Here, then, we are presented with the *ebauche,* or first rude outline of the present theory of gravity,

* See Mr. Whewell's work already cited, p. 224, with the author's observations as to this assumption of Newton being "quite *gratuitous,*" &c.

sketched, as it were, *in the dark*, since it was altogether derived from the conviction which a lengthened contemplation of the subject impressed on his mind, that such a division in the action of this force, in reference to these bodies, must exist. It may be added, in reference to this division of gravity into opposite species, as it subsists between the sun and planets, that its action is not only conformable to the law of the *inverse square*, as refers to these bodies, but that it appears to be governed in the relative degree of the *repulsion* it induces between them by the principle of *magnitude in the reflectors*, the greater, reciprocally, being the amount of the latter, as in the sun and larger planets, the greater being the repulsive force exerted by them on each other, and *vice versâ*. To this law it is, as assumed, that is to be ascribed the circumstance, that the extreme amount and magnitude of the members which compose the opposite grand divisions of the solar system are situated at its opposite extremes; and where, as in those of *Jupiter* and *Saturn*, the primary planets are accompanied by satellites,—accurate observation, I doubt not, will show that the same law equally exists between these bodies; the smaller of the satellites being those situated next the primary orbs, and the larger those which revolve at greater distances from them. It will further appear that this disposition is not only that which accords with the principle of *re-*

reflective action between the ensemble of the planets and the sun, but that by any other disposition of these bodies in reference to the sun, a total disparity between the opposite or positive and negative species of electric action on the planets would ensue; whereas, by this the present disposition of the planets,—as they recede from the sun, and that the relative intensity of his positive action decreases, a smaller aggregate of the negative action of the system subsists. On the contrary, from this disposition, as the planets approach nearer to the sun, and that his positive action increases in intensity,—from the larger of the former, and consequent aggregate amount of the negative action of the system being situated on the *opposite side*, that an equalization, or at least an approximation thereto, in the mean action of the opposite or positive and negative species of the electrical forces of the system on the principle of their temperature is effected. Thus, it may be observed, new adaptations and harmonies will still be found rising in view and keeping pace with our advances in the knowledge of nature and her dispositions. Of this, indeed, a further and very striking illustration, equally as of the local union of gravity with magnetism and electricity in the sun and planets, (the bond of which union is reflective action,) will be found in the circumstance that notwithstanding the *direction* in the local action of each force in these bodies, as in

the earth, is peculiar to itself, and different from that of the others; yet that the mean local, or most powerful action of all three, concentrates and circles on the same plane, viz. that of the *surface* of each of these bodies. Thus, it will be seen, identifying and uniting the point of their *greatest utility* with that of their *most powerful agency*. To this law in the local action of the primary forces on the sun and planets, however apparently the contrary, the action of gravity will not be found an exception, as its force will be found to decrease equally in descending into the depths of the earth, as in ascending from its surface; which circumstance, in reference to the local action of gravity, would favour the idea entertained by some, that the earth and the other heavenly bodies are *hollow spheres;* of which, as though to furnish the proof, the *rings of Saturn* are to be considered but as the *sections*. And as to the correctness of this idea, a further argument might be drawn from the extraordinary *economy* observable in the dispositions of nature in limiting the range of all things to their *utility*, (of which the low range of temperature in the atmosphere may be cited as an instance,) as from the total inutility of having the centres of these bodies composed of *solid* matter, since the local action of the primary forces on their elements is in no case to their centres but superficies, it may fairly be inferred that so composed; to which circumstance

probably, and to that of the main focus, or centre of gravity, as assumed, equally as those of the electric and magnetic forces, being situated between the tropics, may be ascribed the relative *flatness* of the poles of the earth, and the cause of the difference which is found to exist in the force of gravity at the poles and at the equator, as ascertained by pendulum experiments; the fractional difference alluded to, as is known, being 1-194. A last, and, as appears to me, conclusive proof, in reference to the principle of *reflective action*, as assumed by our theory, is furnished by the fact that the *loadstone*, when dug from the mine, *is not magnetic*; nor does it become so till after it has been some time exposed to the action of the atmosphere: and further, that it is only in consequence of its source being external, or derived from the sun, that magnetic action in the atmosphere could affect the needle in making it point to the opposite poles of the earth; or finally, (as long since ascertained by Cassini and others,) that the diurnal variations of the needle, in keeping exact pace with the changes in the position of the sun, can be either understood or accounted for.

Such, it may be observed, is a cursory summary of the leading facts and arguments which I have to offer in reference to the principle of *reflective action*, regarded as the leading and fundamental principle not alone of our theory, but of nature

itself, in the planetary world. And, in reference to the latter, as showing the analogies which every where prevail between the physical and moral world, we may observe that the dominant or executive principles which preside over, wield, and impel the grosser parts, both lodge in and are confined to the finer and more subtle; which, as they extend, envelope and connect the various members of our planetary system, are the wings that transmit and give energy to their active forces; and which serve, at the same time, as the medium of developing the adaptations and harmonious dispositions implanted by nature, and consequently inherent in these bodies. And the union of such opposite species of matter in the physical world, similar to the union of body and spirit, or directing intelligence with vitality in animals, is indispensable to their government and well-being. These analogies between both, as observed, though under different forms, being too legibly traced not to be perceptible. And, it will not be esteemed as the least extraordinary circumstance connected with these dispositions in the grand fabric of nature, that the union of both is based on a principle adapted thereto, and exclusively its own; a principle, it may be observed, which at one extremity of the scale, or, as applies to individual parts or members, vanishes and disappears as nothing; whereas, in its opposite extreme, or that in which it circles and embraces within its range

the entire of the members of our system, with their capacious spheres of action, becomes at once the bond of their union, the main spring of their forces, and the immutable basis of their stability and common conservation. A principle, moreover, which, in its application, may be considered as affording the most perfect type of the Divine source from which it emanated, based and subsisting as it does solely by and on that of UNITY ; and which, being the assumed fundamental principle, or ***first cause***, in its connexion with astronomy and physics ; as it has proved efficient in sustaining the frame-work of nature through the eternity of the past, now that its existence and multifarious relations in reference to science are brought to light, it is not likely, in its connexion with our theory, that either the sophisms or subtleties of the schools, will easily displace it. Its importance as a discovery, indeed, is of such magnitude, as relates not merely to the interests of astronomy, physics, and meteorology, but to the entire circle of subordinate sciences, that we not only are, but for some time must continue to be, ***too near***, either to see, or be able fully to appreciate the extent of its relations.

One word more ere dismissing this part of our subject. Independent of the facts and arguments already advanced in support of the leading assumptions connected with our theory of ***reflective action***,— do we not, I ask, discover an additional and most

powerful one in the circumstance, that this is the only theory which, by removing from the face of nature, as connected with the sun and remainder of the planets, including the earth,—that crowd of disjointed relations and associations, whether as relates to the principle of *temperature*, the force of *gravity*, relative *density* of the centres of the planets, and of the earth, &c., which, the moment we extend our views from the *surface* of the latter, every where present themselves as seen through the deceptive lens held up to us by received principles, or established opinion; thus redeems her from the unjust imputation of being the parent of such startling and monstrous anomalies, by reducing and reconciling her operations in the various members of our planetary system, to a common standard of unity and identity. As though it were not in the power of nature to attain to or establish harmony and perfection, by her dispositions, in any of these bodies, except in the one that we inhabit! Without referring to the Newtonian calculations, in reference to the different temperatures assumed to subsist between the external planets, and those situated nearest the sun, that the excessive temperature of comets when in their perihelions, &c. which belong rather to a former, than to the present state of astronomical science. A few extracts from the work already alluded to, lately published by the Reverend W. Whewell, will be sufficient to illustrate. Thus, in treating of the

Mass of the Earth, p. 43, we find the following observations:—"The force of gravity might, so far as we can judge, have been different from what it now is. It depends upon *the mass of the earth;* and this mass is one of the elements of the solar system, which is not determined by any cosmical necessity of which we are aware. The masses of the several planets are very different, and do not appear to follow any determinate rule, except that upon the whole those nearest the sun appear to be smaller, and those nearest the outskirts of the system to be larger. We cannot see any thing which would have prevented either the size or the density of the earth from being different, to a very great extent, from what they are." In reply, as to the contrary of this assumption, we have but to refer to the preceding observations which relate to this disposition of the planets in reference to the sun. Again, p. 9,—"The law of the gravity which acts to the earth and to Jupiter, is the same; but the *intensity of force* at the surfaces of the two planets *is different.*" And reasoning on this assumption, we find the following passage in p. 50:—"If the force of gravity were increased in any considerable proportion at the surface of the earth, it is manifest that all the swiftness, and strength, and grace of animal motions must disappear. If, for instance, the earth were *as large as Jupiter*, gravity would be *eleven* times what it is; the lightness of the fawn, the speed of the hare, the

spring of the tiger, could no longer exist with the existing muscular powers of those animals; for man to lift himself upright, or to crawl from place to place, would be a labour slower and more painful than the motions of the sloth. The density and pressure of the air, too, would be increased to an intolerable extent, and the operation of respiration, and others, which depend upon these mechanical properties, would be rendered laborious, ineffectual, and probably impossible." "It has sometimes been maintained by fanciful theorists, *that the earth is merely a shell, and that the central parts are hollow.*" All the reasons we can collect appear to be in favour of its being a solid mass, *considerably denser than any known rock.* If this be so, and if we suppose the interior to be at any time scooped out, so as to leave only such a shell as the above-mentioned speculators have imagined, we should not be left in ignorance of the change, though the appearance of the surface might remain the same. We should discover the want of the usual force of gravity, by the instability of all about us, &c." Again, in treating of the "*stability of the ocean,*" p. 180, we find the following:—"The density of Jupiter is one fourth, that of Saturn less than one seventh, of that of the earth. If an ocean of water were poured into the cavities upon the surface of Saturn, its equilibrium would *not* be stable. It would leave its bed on one side of the globe; and the planet would finally be composed of

one hemisphere of water, and one of land." And, finally, in referring to the assumed laws of attraction, p. 161, " If the positions of the planetary orbs, with respect to that of the earth, were to change much, the planets might sometimes come very near us, and thus exaggerate the effects of their attraction beyond calculable limits. Under such circumstances we might have " years of unequal length, and seasons of capricious temperature, planets and moons of portentous size and aspect, glaring and disappearing at uncertain intervals;" tides like deluges, sweeping over whole continents; and, perhaps, the collisions of two of the planets, and the consequent destruction of all organization on both of them, &c." In these extracts, I say, we are furnished with tolerable specimens of the incongruities, and monstrous inferences, to which the supposed laws of attraction, and universal gravitation necessarily lead, and give birth :—clashing as such inductions do with every thing we see, and disjointing by inference the whole frame-work and dipositions of nature in reference to the sun and planets. Sir Isaac Newton himself was not insensible of this tendency in his theory of gravitation, of leading to such anomalous inductions; as we are informed by the Reverend W. Whewell, in his work, p. 342, that he, Sir I. Newton, laboured to reduce gravity to *some higher law,* and *the forces of other physical operations to an analogy with those of gravity,* and de-

clared *that all these were but steps in our advance towards a first cause.*" Why, then, it may be asked, waste time in collecting proofs, as to the insufficiency—to use no harsher term—of the Newtonian theory of gravitation? as in thus recording his opinion in reference thereto, he has spared others the necessity of doing so.

This *first cause,* then, to the discovery of which the latest aspirations of the illustrious Newton were directed, being at length brought to light in the primary and fundamental principle of *reflective action,* as recognized by our theory; its first effect is, as might be supposed, to reconcile nature with her works, and both with reason and perfection; thus removing all these seeming anomalies and contradictions, and substituting in their place those endless harmonies and adaptations which a correct knowledge of her dispositions in the planetary world (of which we have attempted to trace the feeble outline), cannot fail to develope and bring to view. For, by means of the principle of reflective action *that* may be anticipated, which has been so eloquently described in his work by the Reverend W. Whewell, p. 325, as taking place when a new law of nature is discovered, viz. " A number of facts in which, before, order and connexion did not appear at all, or appeared by partial and contradictory glimpses, are brought into a point of view in which order and connexion become their essential cha-

racter. It is seen that each fact is but a different manifestation of the same principle; that each particular is that which it is, in virtue of the same general truth. The inscription is decyphered; the enigma is guessed; the principle is understood; the truth is enunciated."

"Dieu me garde *de faire un systême!*" exclaimed *Voltaire,* in the person of one of his characters. And this, be it observed, after he had, during some years, similar to his countrymen Pascal (whose latter years, as a *physician,* by no means, as observed by Voltaire, corresponded with his early promise),—tugged at, though unsuccessfully, and measured his strength with this bow of Ulysses; and after his friend *Clairaut* had succeeded in dissuading him from a further continuance of the pursuit.* And it will be admitted that Voltaire did not so express himself without some reason. For, notwithstanding that in nature "all things are ordered," as we are told, "by number, and weight, and measure;" and, consequently, that all things therein are conformable to, and founded on *system*:—yet such, so various, and, it may be added, so *multifarious,* are and have always been found, the difficulties connected with

* "Après avoir donné quelques années à *la physique, Voltaire* consulta sur ses progrès, *Clairaut,* qui eut la franchise de lui répondre qu'avec un travail opiniâtre il ne parvîendrait qu'à devenir *un savant médiocre,* et qu'il perdrait inutilement pour sa gloire un temps dont il devait compte à la poésie et à la philosophie."—Vie de Voltaire, par M. Condorcet, p. 67 and 68.

unravelling the latter, that it would seem rather intended to tantalize and distract the human mind, with the prospect of attaining to the possession of a distant and flattering, but ideal acquisition, than an end within the power or compass of its faculties to attain. In proof of this, let us suppose the preceding astronomical assumptions to be correct, and take into account that, together with the facts brought to light by the discoveries of others, as by that of their author, in reference to the analogy between the lunar action on the tides and temperature, (all, be it observed, previously indispensable, in order to any advances being made therein,) combined with the lengthened series of comparison and induction demanded by the double task of developing, arranging, and moulding them in the order in which they appear; and yet, that success to this extent, combined with the various means it afforded, went no farther than to place the author of these assumptions in a position to make *his first advances in meteorology*. And should it happen that his humble endeavours in this department of science, should be attended with more success than has fallen to the lot of other and abler men, it may serve as a new proof and illustration, "that the race is not always to the swift, nor the battle to the strong;" but that the circumstances of "time and chance" must concur, and be equal contributors to such results.

It was some years previous to the publication of

my work in 1830, that the strong conviction I felt of their being well founded, led me to adopt the general conclusion, which served as the bases of the preceding astronomical assumptions, then, for the first time, submitted by me to the public. To these assumptions were added such ideas as their first, and, necessarily, very imperfect application to meteorological phenomena had suggested; as may be seen in the part of the work which more particularly treats of the atmosphere and its phenomena. For, as observed by Mr. Whewell, in his work, p. 324, " The first discovery of new general truths, and the development of these truths, when once obtained, are two operations extremely different." It was not, however, so much as referred to *principles*, as in the more difficult department of tracing their connexion, and applying them to the various details of atmospheric phenomena, in such way as to show and make evident the existence of their mutual relations, that the defects and deficiencies of this part of my former work consisted. And as the chief, if not the sole, utility of these principles consisted, and must continue to consist, in the circumstance of their being susceptible of being made applicable as elements for calculating in advance, the nature of the approaching seasons and changes of the weather; and that neither their connexion with, nor the manner of their being made so applicable, was then sufficiently advanced ; and that their publication in the

form then assumed, had not the effect of awakening public attention, so as to interest it in assisting to make them so applicable. The consequence was, what, under such circumstances might have been expected, viz. that the publication of my work was only productive of failure and loss, and left me the alternative, either to prosecute the subject single-handed, or to stop short, and abandon all further attempt as hopeless. And certainly, if no considerations but those connected with my *personal interests or feelings* had been allowed to interfere in the decision, (the losses induced by my publication, added to the reception—little flattering—which the few communications I had made to scientific bodies, whether in France or England, in reference to these principles, had met with,) I could not for a moment have hesitated as to the course which the most ordinary principles of prudence would have suggested. However, believing that man but little worthy the honour of prosecuting to success an undertaking such as this, who could allow himself to be governed only by the same principles of action as would serve in ordinary affairs; and having had no reason from increased acquaintance and examination of the meteorological principles I had assumed, to doubt their correctness, I determined to persevere,—believing, with *Helvetius*, that, " L'éloge général et du moment est presque toujours exclusif de *l'éloge à venir*." Aware, likewise, that " La marche de la verité *est*

lent;"—and that "*C'est à la constance des desires* que sont attachés les grands succés;"—and that a period might arrive when, as in the case of *Tull*, of *Fulton*, of *Watt*, and so many others,—very different ideas than those elicited by its first appearance, might be entertained on the subject of my pursuit. I may add, that I have no reason to regret this decision, as the increased acquaintance with the various bearings of that most complicated of subjects—*the weather*—which has grown out of the four years additional observation made since the publication of my work, enables me at present to place the whole subject in such a form, and point of view, as, simply on the score of *its utility*, to insure it, I hope, not only a very general share of public attention, but support. Indeed, from the very nature of the subject, it were preposterous to suppose that, even with the full knowledge and aid of *correct principles*, any more than a relative degree of perfection in meteorological science could, for some time, be attained; for, as the atmosphere is at once the theatre and focus to which all the active forces of nature in the planetary world continually tend and converge, as to that of their final development and palpable expression; and that though, when discovered, its phenomena, from being the expression of these active forces, were those which, by reason of the every-day proofs they afforded, would place the correctness of the principles deduced from these forces, beyond

doubt or suspicion. Yet, however palpably manifest the first principles and contributing causes, whose final effects are expressed in the weather might be,—owing at once to their number; to the variable scale, whether, in reference to latitude or locality on which they act; and to the changes continually taking place in this scale, with the changes of the seasons;—each variation necessarily inducing some corresponding variety in the effects or expression of such action in the weather. It will, I say, readily appear that, with this full and perfect knowledge of principles, the task of arranging and reducing them to such a form as to make them equal to all the contingencies demanded by the subject, could only be a work *of time*, and much industry. And, consequently, that though such perfect arrangement of the subject did not accompany the first publication of the principles of our theory, this constituted no proof as to their not being mainly correct and well founded. And, notwithstanding that it is in some measure anticipating our subject, as an idea of the course pursued by me in prosecuting my inquiries in this department of science, and to which much of the success with which they have been attended is to be ascribed,—may not, in this place, be without its use; I shall, with all possible brevity, lay it before the reader.

It is observed by the Reverend W. Whewell, in the part of his work which treats of *climate*, p. 58, that

"The succession and alteration, at any given place, of heat and cold, rain and sunshine, wind and calm, and other atmospheric changes, appear, at first sight, to be extremely irregular, and not subject to any law. It is, however, easy to see, with a little attention, that there is a certain degree of constancy in the average weather and seasons of each place, though the particular facts of which these generalities are made up, seem to be out of the reach of fixed laws." And long before the work from which this extract is taken had met the public eye, my own observations had satisfied me that this must be so; viz. that similar to the seasons themselves, their chief atmospheric phenomena, however seemingly the contrary, were *less arbitrary,* whether as referred to their *number*, or to *the periods of their occurrence,* than what would at first sight appear. Indeed, this inference and conclusion may be said to be amongst the first or most prominent in the list of those which necessarily followed, and were consequent on the previous assumption of our theory, in reference to the *locality* of planetary temperature. For if, as assumed, temperature were local, and as such—as we know to be the case—determinable in the periods of its changes and extreme degrees,—by an easy transition and parity of reasoning, it must follow, that the chief atmospheric phenomena connected with the changes of temperature in the annual circle, must likewise be determinable both in their number,

and in the periods of their occurrence,—circumstances of locality being the same. For though variations might, and, as being a necessary consequence, *must occur*, in the number, and violence of the atmospheric phenomena induced by the changes of the temperature and seasons in different parallels and localities, incident to the variations in the relative temperature of places, and of the seasons of different years;—yet if, as assumed, *local*, a certain correspondence, conformity, and proportion, would subsist between the principle of atmospheric temperature and its accessory phenomena in the same localities, in the same seasons of different years. These, I say, were amongst the earlier conclusions to which my assumption as to the locality of temperature led. And further observation not only showed me that this was really the case, but that each quarter of the annual circle or year, had a period to which the other atmospheric phenomena of such quarter, as if by *accumulation* tended; and found vent, in giving birth to the most violent phenomena of such quarter; and to which its other phenomena of the same class were, in point of force or violence, *secondary* or subordinate in degree: and owing to which, and to their number in each quarter being limited to a particular period; this latter has been denominated by me, in our theory, the *chief storm crisis* of such quarter. However, though the correctness of the facts alluded to was but more fully

confirmed by continued observation; yet neither the periods of the occurrence of these storm crises, nor the relative degree of the violence of their phenomena during *one year*, as contrasted with *another*, whether preceding or following, were found exactly to correspond. But as the sum of the differences in these relations of time and intensity were found, notwithstanding, to be restricted and confined within certain determinate limits; this circumstance helped to simplify the task of ascertaining the causes in which these differences had their source. And as, in the first place, these violent atmospheric phenomena were assumed to be so intimately connected with the principle of its temperature, that they were to be considered only in the light of *accessories* connected with its changes; a first cause of these differences, in different years, was found to have its source in the variations which took place in the temperature of the seasons of these years. This difference in the temperature of the seasons of different years, however, not being of itself sufficient to account for the extent of the eccentricities observable in the periods of the occurrence of these violent phenomena; it showed that another element, as referred to the periods of their occurrence, existed, which it became necessary to take into account. And this contributing cause, I at length ascertained consisted in the *lunar action*;—for, as the period of the lunar circle at which these violent atmos-

pheric phenomena occurred during the seasons of any one year, never entirely corresponded with the same periods, either in the preceding or succeeding annual circles; thence, circumstances of locality, and even temperature, being the same,—it was impossible, admitting the existence of a lunar agency on the weather, that these violent phenomena could occur at precisely the same periods of the annual circle during any two years consecutively. However, by admitting the existence of a lunar agency on the weather, proved by the analogy between the lunar action on the tides and temperature; and by the further discovery that, (as electric action in the atmosphere is of opposite kinds, *direct* and *inverse*, of which the former is more particularly connected with the principle of its temperature, as the latter with the formation of rain, and these violent phenomena its accessories;) there exists throughout the year *an order of occurrence* of these opposite kinds of electric action in the lunar circle. Having, I say, succeeded in this point, and kept my attention continually directed, to ascertain what relation these supposed accessories in the development of the violent class of atmospheric phenomena might have with the periods of their occurrence; I soon found I had lit on the true causes of the differences alluded to; as, combined with the minor differences, equally marked, though less extensively influential,—induced, at times, by the difference of *locality;* I found

the correctness of the principles I had assumed, in all material points, proved and borne out by the periods of occurrence of this class of phenomena. And that, in the discovery of these causes,—together with their supplying the most unequivocal proofs as to the correctness of the meteorological principles to which they were referred,—I had likewise discovered elements, for *calculating in advance*, the periods of occurrence of this the violent class of atmospheric phenomena throughout the year. For, as I found that a relationship so strict subsisted between *the temperature in winter*, and the temperature and weather of the succeeding seasons,—circumstances of locality being the same,—that it furnished a guide to a knowledge of the latter, such, as hardly admitted of an exception. And as a principle was thus obtained for ascertaining *in advance* the nature of the approaching seasons, at the commencement of the year,—it only required, in reference to calculations founded thereon, to take into account the periods—pointed out in the Almanac,—when, during their progression, the *lunar action*, from becoming a party to the development of this, the violent class of atmospheric phenomena connected with the seasons, would be the most likely to determine *the precise periods* of the occurrence of these phenomena, *in order to the ascertaining of the latter*. Thereby, as will be seen, supplying the means to those whose interests might be compromised by these pheno-

mena, of neutralizing their injurious effects, by enabling them to anticipate the periods of their approach. And thus, that a triumph was connected with, and reserved for the discovery of *the true system of the world,* which, in point of utility, was in all respects worthy of, and commensurate thereto; and which would continue to remain, at once, as its best testimony and proudest trophy; as it would supply *a new element* of security to commerce and maritime affairs, nothing inferior to that which arose out of the polarity of the magnetic needle.

Deeply impressed with this conviction, as with that of the incalculable advantages the publication of these principles and the facts connected therewith was likely to be productive of; but being desirous at the same time of ascertaining to what extent I might count on *public support,* in the event of bringing out the present work, (then in a considerable state of forwardness;) towards the close of 1831, being in London, I circulated some hundred copies of a prospectus of the work, in which I stated that one of its leading objects was to enable mariners to ascertain in advance *the periods of storm* throughout the year. But these prospectuses, however far they might have answered the purposes of an advertisement, had so little success in procuring signatures,* that I thought it most prudent to

* As being amongst the most distinguished of the *few* who, by the promptitude with which they responded to the appeal thus

abandon the idea of publishing for the time. Whether, however, the public was right in thus withholding its support, in seconding an attempt such as this,—I shall leave the enormous losses by sea since sustained by the commerce of this country to answer; for if, out of the 100,000 tons of shipping said to have been lost during the sole winter of 1833, even a *fourth part* had been saved by the then publication of this work, it is easy to see on what side of the account the balance of profit had lain. However, we improve as we advance, and perhaps a different reception awaits this volume at present. That this want of support was entirely attributable to *incredulity* on the part of the public, there is little reason to doubt; but if public incredulity were to be taken as a test in affairs of this kind, the application of *steam* to navigation, as is known, had still remained untried; not to cite any further instance of its fallibility as a guide. Of

publicly made in the cause of science and humanity, showed they did not consider the object proposed by me as being altogether chimerical or beyond the range of attainment; and as being, at the same time, the only tribute of respect in my power to offer to departed worth, may be mentioned the late *Lord Dover*, the Mæcenas of his day! Who, however effectually he may have secured to himself a lasting fame as an author, and a patron of learning and science, was, alas! for the interests of both, but too soon called off from a world where such examples are so rare,—yet so necessary! and of whose early demise it was no less feelingly than justly observed, that "if length of days were to be commensurate with personal merit, his life would have been one of no ordinary duration."

public opinion, indeed, it may with reason be observed, that though *in the end* it is usually right; it is as usually *the contrary* in regard to things lying at all beyond its *portée* when they are first arraigned at its tribunal. Thus showing that even for the interest of the public itself, a necessity always exists in the community for the presence of a higher species of judicatory, different from, and superior to public opinion; in order to give its true direction to the latter, in reference to encouraging, by a liberal policy, an examination of all matters in the early stages of their introduction, or before they have struck root in the public mind, which, however unpromising they may appear, hold out the prospect of much public utility. As being in addition to the preceding statement conclusive, in reference to the necessity which exists, and has always since the dawn of commerce existed, for a work such as this pretends to be, in nautical affairs; and as being at the same time a document which may not have fallen under the inspection of the generality of readers, I give insertion to the following article, copied from the *Dublin Pilot* newspaper of the 22d of August, 1832, viz.:—" From an examination of Lloyd's Lists, from the year 1793 to the commencement of 1829, it has appeared that the number of British vessels, alone, lost during that period, amounted on an average to *no less than one and a half daily*. We learn from Moreau's tables that

the number of merchant vessels employed at one time in the navigation of England and Scotland, amounted to above 20,000, having, one with another, a burthen of 120 tons. Out of 551 ships of the royal navy of England, lost to the county during the period above mentioned, only 160 were taken or destroyed by the enemy, the rest having either stranded or foundered, or having been burnt by accident; a striking proof that the dangers of naval warfare, however great, may be far exceeded by *storm, the hurricane,* the shoal, and all the other perils of the deep. During the last great war in Europe, thirty-two British ships of the line went down to the bottom in the space of twenty-two years, besides several fifty-gun ships, eighty-six frigates, and a number of smaller vessels. The navies of the other European powers, France, Holland, Spain, and Denmark, were almost annihilated during the same period, so that the aggregate of their losses must have many times exceeded that of the kingdom of Great Britain. These numbers, we believe, very far exceed what most people would have supposed. To this immense loss of ships of war and commerce, the imagination must be left to supply the incalculable amount of wealth swallowed up with them, and the thousands of human beings who thus found a watery grave." Further comment to prove the necessity which exists for a work like the present, after a statement such as this,—not

taken from hearsay, but collected from authentic documents,—were superfluous; it speaks for itself.

And here I should willingly close the present article, were it not that esteeming it, as I do, as being an essential part of the work itself, some further circumstances, chiefly referring to the fundamental principle of our theory, *reflective action*, as more particularly connected with meteorology, demand a cursory notice in this place.

The first in the list of these circumstances shall be the assumed analogy between the lunar action on the tides and temperature; in reference to which it may be demanded, if such analogy exist, as assumed, why is it that it is not more frequently *apparent?* To this we may, in the first place, answer by demanding, why is it that, as observed by the sage, *truth* lies not at the surface, but rather at the *bottom* of the well? Or why is it that what are esteemed as being the most precious things in nature, such as diamonds, gold, &c., are not the most common, but the contrary? Were this analogy more frequently palpable, its existence had, no doubt, been sooner detected; but it had, at the same time, on the principles stated, fallen in price, and been less valuable as a discovery. When it is considered, however, that besides being of opposite species,—positive and negative—electric action in the atmosphere is also divisible into opposite kinds, *direct* and *inverse;* and that it is only as connected

with the former, and during its continuance, that this analogy can by possibility become other than *faintly* perceptible on the temperature; at the same time that this the direct species of electric action in the atmosphere is so frequently interrupted or totally suspended by the interposition of clouds and formation of rain; and that, in addition, the currents or winds frequently have the effect of deranging equally, as the formation of clouds and rain, the action of the primary electrical forces on the temperature:—when, in addition to these *disturbing* causes, we consider the relative force of the *lunar*, as contrasted with that of the *local action* of the opposite primary electrical forces of the sun and earth on the temperature in the annual circle, the wonder will cease that this analogy, assuming it to exist, should not more frequently and palpably manifest itself. In order to its becoming fully apparent, as is usually the case during some time after the equinoxes,—a certain degree of equalization between the opposite actions, solar and planetary, in the annual circle, is, in the first place, necessary; to which must be added, a partial suspension of the currents or winds; combined with a dry sky. For, without the concurrence of these circumstances, which can only take place about the periods of the equinoxes,—neither the nature nor extent of the lunar action on the temperature can be fully ascertained, as on the tides. The cause of this difference is,

that the lunar action, as connected with the principle of temperature in the tropical skies, or on the line traversed by *the main focus* of the positive action of the sun, whence the impulsion is derived in which the tides have their source,—extending thence to the opposite poles,—*is never interrupted,* as with us: it being there only—similar to the solar action—that the changes in the *collective force* of the lunar tides on the atmosphere of the opposite hemispheres, in *concentrating* on this line, can induce such regularity in their effects as on the tides; at the same time that, throughout the various regions of the atmosphere of the opposite hemispheres on either side, owing to the causes stated, combined with the absence of such concentration as in the tropical skies, the effects of the lunar tides on the temperature is so irregular. The place of such complete demonstration in reference to the temperature, as on the tides, in places distant from the equator, being supplied by a different but no less conclusive class of facts in proof of the existence, the nature, and extent of the lunar action on the weather; and of which, as a more intimate knowledge will be acquired as we go along, I esteem it unnecessary to dwell at greater length on the subject in this place. I may, however, in conclusion observe, in reference to this assumed analogy, that though it should *at first* be the principle of our theory which may appear most apocryphal, it

will, after some time and observation, be *the last,* the certainty of which will be questioned.

Did the facts connected with this assumed analogy between the lunar action on the tides and temperature, however, leave any doubt as to the *local* nature of the latter; such doubt would be removed by a slight examination into the circumstances connected with *climate:* as in this particular we shall find that the powerful influence exercised by *latitude* is not unfrequently merged in the more powerful influence exercised by *local causes;* i. e. by the difference, whether in the *nature* or *force* of the *reflecting surfaces* beneath. For here the proofs, in reference to the principle of *reflective action,* are penciled by the hand of nature with such a breadth and depth of colouring in the climate of countries, that not only in its grand outlines and subordinate divisions, but even in all its fractional details, do we find every thing regulated by and conformable to the principle of *reflective action.* By reference to this principle we are enabled at a glance, to see why it is that the opposite extremes of annual temperature have a wider range in the *interior* of continents than on the shores of the sea, or in islands, circumstances of latitude being the same; and why the temperature of mountains approximates so nearly to that of islands, partly by reason of their defective forces *as reflectors.* On this principle, combined with the marked effects on climate, in-

duced by the radiation of *heat in winter*, as of *cold in summer*, by the waters of the ocean in their vicinity, we can account not only for the vast difference which occurs both in the extreme cold of winter and extreme heat of summer within the same parallels, in these islands, and on the neighbouring shores of the continent, as contrasted with places in the interior of Germany, and further inland; but the still wider range between those opposite extremes of temperature which occurs in the countries of, and appertaining to, the continent of North America, owing to the superior *extent*, and consequent *force*, of the vast body of land superficies contained in the latter continent, as contrasted with our more circumscribed continental dimensions on this side the Atlantic. Thus accounting for and explaining all the circumstances connected with what are called *isothermal* zones, *isotheral* and *isochimal* lines, &c.; and showing, that in the dispositions of nature, nothing is without its use; or other than partially irregular or defective, when apparently the contrary; as even the vast and dreary steppes of Russia, the deserts of Lybia, or the burning sands of Egypt, &c., which, from their total unfitness for vegetation, or the sustenance of animal life, were regarded as so many blanks on the surface of the earth; are, notwithstanding, in the list of her most powerful agents in upholding the aggregate or mean standard of the vital principle of temperature in the atmos-

phere, as *reflectors*. For where, as in these instances, the dispositions of nature in the material world are defective in *one* of the *double relations*, individual and collective, which constitutes, so strikingly, one of their characteristics;—such deficiency is usually compensated for by increased effect in the other; and, as noticed in a preceding paragraph, as our principles, if well founded, should find an *every-day* confirmation of their correctness in the passing phenomena of the weather; so, in like manner, if right, they should find an *every-where* confirmation of their correctness in the peculiarities of climate incident to the nature of the localities. To the searching operation of this double ordeal, I confidently commit them.

Next to the reciprocal relations between these peculiarities of climate and our principles, the quarterly or chief *storm crises* of the annual circle,—from the important consequences they induce, their palpable connexion with the principle of atmopheric temperature, and the species of relation which appears to subsist between them,—claim our attention. For these storm crises not only differ one from the other in the same annual circle; but likewise differ in different years, with the variations which take place in the temperature of their seasons. Thus, in point of relative force or violence, the last of these storm crisis in the annual circle, or that of the *winter progression quarter*, exceeds in violence that

of any other season of the year; while, on the other hand, the storm crisis of the opposite or summer progression quarter is, in general, the least violent, as the most circumscribed in its range, of these electrical crises; and as to those connected with the opposite equinoxes, they appear to be, in great part, determined in the relative degrees of their violence by the temperature of the preceding winter or winters. Thus after a mild, and still more after a series of mild winters, as in the spring of 1833, and of 1834, the chief storm crisis of the vernal equinox is in general but feebly developed; whereas, and apparently as being a consequence of the latter, the succeeding storm crisis of the summer progression quarter is usually *the more violent.* Of this we had ample proof in the terrific gales which occurred on the shores of these islands from the 11th to the 14th of June 1833, of which a notice will be found elsewhere; and in the violent thunder and hail-storms, in some instances accompanied with hurricanes, tearing up trees by the roots, &c., which occurred in different parts of England on the 14th and 15th of June 1834, as reported in the subsequent numbers of the London *Globe* of the 23d and 25th of June 1834;—and which thence extended to Ireland, in the violent gale which occurred there the day after, on the 16th. Indeed, it is a characteristic of these storm crises, connected with the periodical rains in our skies at the commencement of summer,

that they set in with *thunder* and hail-storms ; and finish in rain and *storm*, unaccompanied with thunder : and that, as the former are much circumscribed, the latter are more widely extended in their range. The same observations as the preceding, apply equally to the chief storm crisis connected with the autumnal equinox, and that of the winter progression quarter. For, as the relative mildness or intensity of the phenomena of the chief storm crisis connected with the autumnal equinox, as in spring, appears to be determined by the relative mildness or severity of the preceding winter or winters :—after mild winters, as in 1833, the storm crisis connected with the autumnal equinox is less violent and destructive ; but, on the contrary, that by which it is succeeded in the winter progression quarter, is, apparently, the more terrific, —unfortunately but too fully proved by the destructive gale of the 29th of November, 1833, and others, though less violent, of this season ; as will be found more fully noticed under their proper heads. On the other hand, after severe winters, as in 1830, the vernal storm crisis is in general most powerfully developed ; and that of the commencement of summer proportionally less so : and so, likewise, in reference to those connected with the autumnal equinox and winter progression quarter by which it is succeeded,—the increasing of intensity in the first being lessened in that by which it is followed ; and *vice versâ*. Instances connected with these assump-

tions will be found under their proper heads in the body of the work. I may, however, further observe, in reference to those storm crises, that after mild winters they occur *earlier;* after severe winters *later*. The periods of the occurrence of these storm crises, after severe winters, are usually the middle of March; the latter end of June, or later; the commencement of October; and the middle of December: whereas, after mild winters, as will be seen marked in the subjoined diagram of the annual circle of 1833, they commence as early as the middle or 20th of February; the first thunder storms connected with that of the summer progression quarter, as early as the middle of May; that connected with the autumnal equinox, in the latter days of August, or commencement of September; and that by which it is succeeded, towards the close of November: they being thus spaced in the annual circle, as nearly as the corresponding lunar action at these opposite seasons of the year which admits of their occurrence, arrives, to favour their development—about *three months* apart, one from the other.

In reference to other circumstances connected with the seasons and weather, as to the parent science of astronomy itself,—from the present work being limited chiefly to the object of serving as a *Guide-book* to the former; an attention to brevity obliges me to omit noticing either here or in the work itself, a number of these circumstances, which,

though connected with the subject, are not so much so with the immediate object of the work, as to render their introduction necessary. Consequently, not only as regards these, but for more ample details on many of the subjects touched on in these pages, I must beg to refer to my astronomical work, the "*Rudiments of the primary Forces*," &c. And, as dwelling further on circumstances connected with the seasons and weather, were but to anticipate these subjects as treated in the subsequent pages, I shall only add that, notwithstanding our meteorological principles, whether as connected with the temperature, and the progression of the seasons and weather, or with the order of occurrence of the opposite classes of atmospheric phenomena in the lunar circle, are of universal reference; yet, that, as *locality* has so much to do in all things connected with meteorology, and that the ensemble of our observations refers chiefly to the climate of these islands and countries lying within the same parallels; there are, consequently, many peculiarities connected with the seasons, the periods of their changes, and the phenomena incident to the latter; and, as will be seen by reference to the work, variations in the weather of the eastern and western hemispheres, incident to the changes in the position of the moon in the ecliptic—circumstances of season and latitude being the same,—which it were proposterous to sup-

pose, individual observation or industry, however great, could arrive at the exact knowledge, or become fully cognizant of; but which, notwithstanding, it were of the utmost importance to ascertain.—In order to this, and to the correcting of any particular part or assumption of our theory, which, on examination, it might be found to require, as well as to give such further amplitude to others as they demand, or were susceptive of, and thus to make its principles equally universal in their application, as is the immense theatre to which they refer,—much, it will be seen, still remains to be effected. And however efficient it may be in these countries,—far from supposing the last hand put to meteorological inquiry by the present work, its author, on the contrary, is fully aware of the necessity which, in order to such a consummation, exists, and for some time must continue to exist, for the continuance of such inquiry, on an enlarged scale. He begs to suggest, that a leading object of such extended observation and inquiry should be, the collecting materials for the construction of *meteorological charts of the seasons*, adapted to the eastern, and western hemispheres, and their respective zones. And in this, similar to other departments of science, such as geography, geology, &c., but one course remains to be taken which can be attended with success, viz. the establishment of a *society* for the purpose; to be denominated, we will suppose, the

"*Meteorological Society;*" which, at the same time that it contributed to disseminate the knowledge of meteorological principles, could, by its correspondence with other scientific bodies, and with persons resident in different countries, shortly obtain a mass of intelligence connected with the most material points, such as would enable it to execute with facility and correctness those important *meteorological charts* alluded to, as companions to the Almanac, for all climates. This once accomplished, leaving matters connected with agriculture and minor concerns out of the account, it is easy to see the revolution that would be effected in navigation; the annual amount of saving in life and property,—in capital to insurance companies, and, consequently, to the body of society, &c., thus snatched from the submerging waves of the ocean, and the wasting breath of the hurricane!—a victory, alike worthy of heaven to witness, as of science to achieve. To this object, then, I would beg to direct the attention of the friends and patrons of science in this country; and further beg of them, that, in doing so, they keep the objects of *utility* sought to be effected, steadily and solely in view; without allowing themselves to be diverted from, or stayed, by childish considerations, as connected with the quarter from which the suggestion comes, or the qualifications of the party who has the honour to make it. So that if, at length, a spark of Prome-

thean fire has descended, to irradiate by its presence this, and other of the dubious paths in the highest departments of science—the sole study may be, to make it as soon, and as generally available, as circumstances will allow of. And if, as would appear, it comes recommended at once, by the double claim of expediency and truth,—it would seem anomalous if, in a country which, more perhaps, than any other under heaven,—from the extent of its foreign possessions and commerce,—has occasion for the succours it may yield; and in a country, too, which prides itself upon having given birth to a Bacon, a Locke, and a Newton;—such an appeal should be, either tardily, or but partially responded to. It has been well observed, that "*man is born barbarous,*" and that "he is ransomed from the condition of beasts only, by being *cultivated.*" And as what applies to the individual, applies equally to the species; and that all society was in its infancy barbarous, and only redeemed from this state by cultivation;—and thus that the bulk of the miseries which have weighed on and afflicted society in its earlier stages, should be fairly placed to the account of *ignorance*, and considered as *penalties* attached by the GOD OF INTELLIGENCE to this *unnatural state of man:* and, consequently, that those miseries and imperfections in the social state which have been already redressed, or may be hereafter redressed by its further cultivation,—and the extension of science and discovery

inseparable from the latter,—should be set down ***as so many bounties*** conferred by the same beneficent Providence, on every new extension of his intelligence effected by man.—Together with showing the vast accessions to the aggregate stock of his happiness and interests which may still be attached to, and anticipated from, the further cultivation and development of this godlike principle:—and by regarding the subject in this, its true light,—at the same time, that it will help to exalt our ideas of the dignity connected with cultivating pursuits after knowledge, it will hold out an additional incentive to the latter, as being at once pregnant with utility to man, and grateful in the sight of the Deity.

SUMMARY OF PRINCIPLES.

If I might be allowed to apply the language of a celebrated astronomer, (Laland,) in reference to comets, to *the lunar action on the atmosphere,* I should, without hesitation, say with him, "It appears to me, that almost every thing depends on *the lunar action.* The only thing I should recommend to my correspondents were, to look after and attend to, the *lunar action; the knowledge of the lunar action is alone wanting to complete the science of astronomy.*"* Thus, assuming the knowledge of the lunar action on the atmosphere, to be that alone, which combines in it, all the elements required, in order to explain, on principles not to be controverted, the grand problem of physics, in reference to the source and nature of planetary temperature, and the other local phenomena of the heavenly bodies.

It was the deep conviction entertained by me of this truth, when accident first caused me to direct my attention to astronomy, and as time enabled me to give the subject more ample consideration,—

* See History of Astronomy for 1801.

which, after some years observation, induced me to publish my astronomical work, the "Rudiments of the Primary Forces of Gravity, Magnetism, and Electricity, in their agency on the heavenly bodies;" a work, I may add, first suggested by the discovery I had made in reference to the analogy between the lunar action on the tides and temperature of the atmosphere. And having thence, by my continued observations of this, the lunar action, combined with the application of my discovery, to ascertaining the changes which at different seasons take place in it, as refers to the weather, been enabled to speak with increased confidence as to its nature and extent; as of the principles which govern and influence it throughout the year in different latitudes and localities; and having directed the application of these principles to matters of *practical utility*, the great and legitimate end of such inquiries, I have, finally, been led to the publication of the present volume. My object in thus presenting it to the public being, chiefly, to fill up the blanks, and supply the deficiencies of that part of my original work, which treats more particularly of meteorology; and, by thus giving it a separate form, and more portable size, to place it—in the capacity of a *guide-book* to the seasons and weather, and *Perpetual Companion to the Almanac*,—more within the reach of the generality of readers. And though, in the introductory observations, it became unavoidable to touch on some

of the leading principles of our theory, I have thought it advisable, notwithstanding, as being a necessary introduction to what follows, to present them in a separate form in this place.

PRINCIPLES—ASTRONOMICAL AND METEOROLOGICAL.

1. The planets and sun, are considered as being the union, or mysterious incorporation of the elements of *three* primary forces; of whose agency, the appearance, movement, and local phenomena of these bodies, is assumed to be the harmonious expression.

2. These primary forces are assumed to be, *gravity*, *magnetism*, and *electricity*.

3. Each of these forces is assumed to be universal or collective, as well as particular or local, in its action on the heavenly bodies. And, of this, the universal and ever-active agency of these forces in the solar system, the principle of *cohesion*, both local and collective, of the bodies which compose it, on which their individual and collective existence depends; their positions, their movements,—*orbital* and *rotary*,—their temperature, and, in a word, the entire of the phenomena connected with the revolution of their seasons; are esteemed either the *fixed* and unalterable, or the *ever varying* but consecutive results.

4. An active *sympathy* is assumed to subsist between the planets, one to the other, as between the sun and planets; in such a way, as that, strictly speaking, nothing connected with these bodies is other than *relatively detached;* being thus collectively regarded, as constituting an ensemble or whole, the different members of which are essential to each other; as it were impossible to detach any one of these bodies, without inducing consequences, more or less injurious to the rest. From this, it follows, that this principle of planetary sympathy, or action of these bodies one on the other, is assumed to exercise an important influence on certain of their local phenomena.

5. This principle of sympathy between the heavenly bodies, is assumed to have its source in the circumstance, that the whole of these bodies, including the sun, are composed of *homogeneous elements.* The difference subsisting between their opposite grand division,—solar and planetary,—being esteemed as no more than *sexual;* a solar principle to a certain extent being assumed to exist in the planets, as a planetary principle to a certain extent in the sun.

6. The *matter* connected with the solar system being of opposite kinds, *solid,* and gaseous or *aeriform,* of which, the former composes the bodies of the sun and planets;—the opposite or aeriform division of this matter which fills the entire of the

regions of space occupied by these bodies, and which, together with excluding the possibility of a *vacuum* in those regions,—by at once enveloping and connecting the various members of the solar system, and being homogeneous in its nature with the matter of which they are composed,—is assumed to be the medium or *conductor* by means whereof this their active sympathy on each other exists, and is communicated.—This the assumed sympathy of these bodies being, in other words, no more than the reciprocal agency on them, exercised by their primary forces of gravity, magnitude, and electricity.

7. Each of the three primary forces is esteemed to be *twofold* in its nature, or divisible into *opposite species*, solar and planetary: the grand source of the one being in the sun, of the other in the planets collectively.

8. A fundamental law of *each species* of the three primary forces is esteemed to be, that its local action in the sun and planets, converges to, and diverges from, a particular point, or *main focus*, where its agency is necessarily most powerful.

9. The three primary forces, though united locally in the sun and planets respectively, are, in their local action in these bodies, perfectly distinct one from the other;—and, as the *opposite species* of each force diverge to opposite main foci, whether in the sun or planets; which, from the circumstance of their being in *opposition*, cannot act *in the same,*

but, on the contrary, must act *in opposite directions* one to the other. This causes that the opposite main foci of each force are situated at *opposite points* of the superficies of these bodies; and consequently, that not only the action of the *opposite species of each*, but that the action of *each force, has a direction peculiar to itself, and different from the others:* whether locally in the same body, or as refers to the system to which it belongs,—considered as a whole.

10. The main foci to which the action of the opposite species of some of the primary forces in the sun and planets converge, are *fixed* in the positions they occupy; those of *others are changeable.*

11. The only one of the three primary forces, the main foci of whose *opposite species are not local,* in each of the heavenly bodies,—and which, at the same time, appear to be unalterably fixed, are those of the primary force of *gravity.* For as this primary force is more peculiarly connected with the *solid matter* of the solar system, it is consequently, on its action more particularly, that the stability of the masses of the sun and planets is based. The main centre of gravity, as connected with the *system*, is neither in the sun nor planets, but is situated at the point between these bodies, where the combined *equilibrium* of their masses centres: and from which the ramifications of its opposite species, in diverging thence, extend to these

bodies; thus separately, as stated, constituting in their *centres of gravity,* the main foci of its opposite species. The *local direction* of the action of this force in these bodies being, as is known, *from their superficies to their centres.*

12. The forces of the *opposite species* of gravity, as refers to the solar system, are exactly balanced one to the other; in such way, that, without the agency of some other force, both the mass of the sun, and those of the planets, would remain immoveably suspended and motionless in their orbits.

13. Different from the primary force of gravity,—assuming the local action of the primary forces, as in the earth, to be uniform throughout the bodies of the solar system,—*a local division of magnetism into opposite species* subsists equally in the sun and planets as in the earth. Thus causing that, dissimilar to gravity, magnetic action in these bodies diverges from a local centre in each, to opposite main foci, denominated their magnetic poles; and necessarily *in the direction* of their axes: thence causing that the local direction of the opposite species of magnetic action in the sun and planets is directly opposite to that of gravity on the lines formed by their axes.

14. Similar to magnetism,—a local division of the primary *electrical force* into *opposite species* exists equally in the sun and remainder of the planets, as in the earth, causing it, like to magnetic action, to

diverge from a local centre in each to opposite poles or main foci. However, as proving its local union in the atmospheres of the sun and planets with magnetic action, and that the action of both forces locally in these bodies has its source in the same *moteur* or first cause, the axes of electric action in these bodies, *traverse, at right angles, those of magnetism*, as described elsewhere; thus causing that the *local direction* of electric action in the sun and planets, is *perpendicular* to the plane of their axes; or, in other words, that as the direction of magnetic action is from north to south, the local direction of electric action in these bodies is from east to west. And, as observed of the primary force of gravity, as refers to the solar system, (that its centre was neither in the sun or planets, but at the point of the system between them, where, as on a steelyard, from their masses on either hand reciprocally balancing each other, that of its equilibrium subsists;) so, it may be added, the local centre of electric and magnetic action, whether in the sun or planets, is not *in* or *on* the superficies of these bodies, but at *a certain elevation* in their atmospheres, from which their axes extend in opposite directions to their opposite main foci situated on their cardinal points at the opposite extremes of their superficies. The elevation of these centres, necessarily varying with the variation in the size of their masses, or superficial contents,—increasing with

the increase of the latter, and *vice versâ.* The cause of this diposition in the local action of the primary forces of magnetism and electricity, and, it may be added, of gravity, in the sun and planets, i. e. that it is *external;* being, that it has its source not in a local or detached, but, on the contrary, in a combined, and consequently *external* principle,—REFLECTIVE ACTION.

15. Each of the three primary forces is assumed to represent *a distinct system* in nature; by the presence and incorporation of whose elements in the sun and planets it is, that each of these forces is connected with, and subsists in each of these bodies; and consequently that the latter, as stated, are to be considered literally, in the eye of science, as the results of the union and incorporation of the elements of these three great systems of nature present in each.

16. The primary forces inherent in the sun and planets deriving their activity in these bodies, as stated, from the principle of *reflection;* and their reflective forces varying with their magnitude as *reflectors;* and it being an assumption of our theory that a common mean standard in the local action of the primary forces, subsists universally throughout these bodies.—The means by which this equalization in the local action of the primary forces throughout bodies differing so widely one from the other, whe-in magnitude or relative proximity to the sun or to

each other, as do the planets,—consists in the difference *in the length of their exposition consecutively* to this reflective action. Owing to this it is, from their superior magnitude as reflectors, that the *primary planets* have *shorter days* than the *secondary;* and that in proportion to the greater magnitude of the former, the shorter is their day. *Jupiter,* whose mass is more considerable than that of the other planets, having *the shortest day;* and *vice versâ.*

17. The stability of the masses of the sun and planets being, as stated, mainly based on the action of the primary force of gravity, both the *angles* formed by their axes with the plane of the ecliptic, and their movements, both *orbital* and *rotary*, are effects of, and consequently depend on the local division into *opposite kinds,* and local *difference of direction* imparted to, the primary magnetic and electrical forces in these bodies.

18. The *orbital movement* of the sun and planets is an effect of *magnetic action.*

19. The *rotation* of the sun and planets on their axes is an effect of *electric action.*

20. The local atmospheric phenomena of the earth, and, by analogy, of the sun and remainder of the planets, have their source in the combined agency of the primary electrical and magnetic forces. These phenomena are divisible into opposite kinds, or species; of which the phenomena of heat and

cold, light and darkness, with their accompaniments, constitute one; and the formation of rain, with the violent accessory phenomena by which it is occasionally accompanied, the other, or opposite class. And, by means of the alternate occurrence or movement of these opposite species of action, and of the phenomena they induce, it is, that the principle of *circulation* subsisting between their eléments of water and air, on which their mutual salubrity depends,—is upheld and perpetuated. It follows that light and heat, whether in the sun or planets, are considered as being of the number of their *local phenomena.*

21. To *the difference of position* of the local centre of gravity in the earth, as contrasted with that of the electrical and magnetic forces in its atmosphere, combined with the variations which take place in the action of the latter; are chiefly to be ascribed *the variations of the barometer, and magnetic needle.*

22. To *the change of position* continually taking place in the main focus formed by the positive electrical action of the sun on the superficies of the earth between the tropics, the earth's movement of rotation, as stated, is to be ascribed; and to the change of position which, with that of the earth in the ecliptic, takes place half-yearly in the opposite or main focus formed by the negative electric action of the earth, from the pole of the approaching

summer, to that of its approaching winter hemisphere at the periods of the equinoxes,—the violent atmospheric phenomena which occur at these periods are to be ascribed; these phenomena being considered as consequent on the loss of the pre-existing equilibrium of this the negative electrical action of the earth throughout the body of the atmosphere, at these periods thus induced; and as continuing, only till this equilibrium becomes again restored in the new direction thus given to it.

23. An analogy exists between the lunar action on the tides, and on the temperature of the atmosphere.—Which, were the action of the opposite primary electrical forces of the sun and earth on the atmosphere, as about the periods of the equinoxes, always balanced one to the other; the development of this analogy would be equally connected with the other regions of the atmosphere as with those between the tropics, where the tides have their source; and with the opposite classes of atmospheric phenomena, would be at all times as strongly marked on the temperature as on the tides. But, from the circumstance that the lunar action, as compared with that of either of the opposite primary electrical forces of the sun or earth, is but *secondary in degree;* and that the development of this analogy is, to a certain extent, dependent on that of the species of electric action in the atmosphere in which this the principle of its

temperature has its source; thence it is, that it is only at certain but determinate seasons of the year, and during intervals of fair weather, that, as refers to our skies, this analogy is equally apparent on the temperature as on the tides. It follows that the tides, equally as the rotation of the earth, the temperature, &c., are esteemed as being of the number of local phenomena which have their source in the principle of *reflective action*, and electrical agency.

24. Finally, it may be observed, that the opposite actions of the primary electrical and magnetic forces of the sun and earth—*positive* and *negative*, on our atmosphere, revolve in *three circles*, diurnal, lunar, and annual. That the manner in which these forces act in each of these circles, is alternate, or by a succession of opposite tides; each *positive tide*, in either circle, being succeeded by an opposite or *negative*, and *vice versâ;* and in the following order, viz. The annual circle is divisible into no more than *two* electrical tides; one positive or *solar*, the other negative or *planetary;* the former commencing its *ascent* at the period of *the vernal*, and terminating this its ascendency at the *autumnal equinox;*—the negative tide in this circle, on the contrary, commences its ascendency at the latter, and terminates it at the former period. The lunar circle, dissimilar from the annual, has *four* electrical tides, viz. two positive, and two negative; the former commence three days before the periods of the *syzygies*, and

terminate three days after the latter periods; the negative lunar tides commence three days preceding, and conclude three days after the periods of its *quadratures*; the intermediate periods in the lunar circle being filled up by what in our theory are called the *intercalary* periods, or *octants*. The diurnal circle, similar to the annual, has no more than *two* electrical tides; one *positive* or solar, commencing in the morning, and terminating at sunset; and one *negative*, commencing at sunset, and terminating at sunrise. Further, it is of the nature of electric action in the atmosphere, that, of whatever kind, it commences by *minor*, and progresses to *major degrees of force*, previous to its giving place in the same region, to a different species of this action. Owing to which law it is, and to the division of electric action, as noticed, in the annual circle, that, as refers to the latter, it is only about the periods of the equinoxes, that an *equalization* in the action of the opposite primary electric forces of the sun and earth on the atmosphere exists:—the action of these forces in the annual circle, throughout the other parts of the year, being divisible into *a dominant*, and *a subordinate action*. Again, electric action in the atmosphere being, as stated, divisible into *opposite species*, direct and inverse, of which the principle of its *temperature* and *fair weather* is more immediately connected with the former; as the formation of rain,

and its accessory phenomena, with the latter species; and the existing dominant action in the annual circle, and the action of the *same name* in the lunar circle,—or *accords* in the action of the primary electrical forces in these the annual and lunar circles, are more particularly connected with the *direct species* of this action in the atmosphere and *fair weather;* as the *opposite action* in the lunar circle, to the existing dominant action in the annual, or periods of *contrast* in these circles, are those more particularly, which are found to induce the opposite or *inverse species* of electric action in the atmosphere, together with rain and its accessories;—and that a similar connexion and dependence is observable between the lunar and diurnal, as exists between the annual and lunar circles.—It being in the former, as in the latter, the *opposite action* in the smaller circle, to that of the existing dominant action, in the circle next above it, which is more immediately instrumental in originating rain in the smaller circle, and *vice versâ.* Thus, and on these principles it is, that *an order of occurrence,* in reference to the opposite species of electric action, in each of these circles, throughout the year, is found to exist; whereby to *calculate in advance,* both the periods when to expect changes of the weather, and also the nature of the approaching changes,—in every latitude and species of locality.

A variety of other circumstances connected with

our subject might, with propriety, be introduced in this place, were it not that, as sufficient is advanced to give the reader an idea of the general outline of our principlcs, such, as it is hoped, will make what follows sufficiently intelligible to him,—a necessary attention to brevity, makes it desirable to omit them. Part of these, 'tis true, may be found in my original work;—and should success attend the present volume,—in a future edition, perhaps, a notice of these circumstances may find a place in its pages. I may, however, add, that however numerous the springs, and complicated the machinery by which the operations of nature in the heavenly bodies,—as connected with their positions, movements, temperature, and, in a word, the whole round of their local phenomena, may appear;—yet, that from the whole of these operations being referable to no more than *three* primary forces, of whose agency they are either the immediate, collateral, or combined results; and that this the local action of these forces is, in its turn, harmonized and regulated, from its being made dependant on a common source, or primary first cause, which, by regulating in every individual case, the relative amount of the local action of each force in these bodies, thus establishes the same common standard of their action on each:—it will, I say, from all this, readily appear, that however numerous and complicated these the operations of nature in the heavenly bodies may be,—from the simplicity

of the principles whence they are derived, and to which they are referable in their development, the most ordinary capacity may, by a little application to the subject, obtain so clear an insight into the grand spectacle thus held up to his view, as to be able to analyze its various parts, and contemplate it in all its bearings and details. By means of these dispositions he will see, (though in contradiction with the principle, that "*matter** never originates its own motion;") that, as applied to astronomy,—owing to the sun and planets, including their atmospheres, being, as stated, the mysterious incorporation of the elements of the three primary forces,—this matter contains within itself, simply from the manner of its distribution in the system,—the elements not only of its own movement in the various members which compose the latter, and of upholding the vital principle of their temperature, and other local phenomena ingrafted thereon;—but that it likewise contains in itself the principle of the renovation of the elements of which it is composed, ***illimitably;*** and with the latter that of the primary forces themselves, of which these elements are the incorporation. Without the latter, indeed, being the case, and that the heavenly bodies were so placed beyond the reach of decay, or power of accident; the principles and

* "Bien loin," observes *M. d'Alembert,* "de prétendre tout ... *plus j'approfondis la notion que je m'en forme,* ... *un abyme d'obscurités.*"

dispositions of CREATIVE WISDOM and OMNIPOTENCE, as refers to the conformation of these the most sublime and astonishing proofs of both, had rendered them, however great, not what they are,—but *imperfect:* and vessels calculated rather to circle on the creeks and inlets of *time,* than on the mighty ocean of *eternity*, for which they were designed. And, notwithstanding, that, as expressed by Sir Richard Phillips—" all is miracle;"—yet, as regards the heavenly bodies, and the physical operations of nature therein, the term *miracle,* would seem only to apply, with propriety, to the circumstance of their *creation.* As, from the disposition and reciprocal adaptation of the three primary forces to the constituent elements of these bodies individually; as to the constitutions of their animal and vegetable kingdoms—reasoning from analogy—and the manner in which, though after the lapse of intervals so widely dissimilar, the entire of these kingdoms and elements, consecutively, respond by the *changes* they undergo, to the action of these forces;—these, the subsequent operations of nature, after the period of their creation, in the heavenly bodies, were made to be, in some sort, *consequent on these original dispositions and reciprocal adaptations.*—And as such, considered in the outline,—these operations partake less of the miraculous, than of the mechanical;—of the fortuitous, than of the determinate and certain;—or, in a word, that they are the necessary

results of these primary dispositions.—" I am," said the mysterious inscription on the Temple of Saïs, " all that has been, all that is, and all that will be, and no mortal has as yet raised the veil which covers me." And, whether these views of nature, to which the inscription referred, may be considered as having at length succeeded in raising the veil, and solving the enigma, it will be for others to decide.

ANATOMY OF THE SEASONS.

LOCAL CIRCLES OF ELECTRIC ACTION.

ANNUAL CIRCLE.—Of the *local circles* of electric action which preside over and control the principle of its temperature, and the other phenomena of the atmosphere,—as being that which, together with comprizing within it one entire revolution of the seasons, constitutes the basis of the action of the electrical and magnetic forces in the minor, or lunar and diurnal circles:—the annual circle, as connected with meteorology, is that which necessarily holds the first place; and in the order of precedence requires should be the first treated of.

The electrical tides in the *annual circle,*—as refers to either hemisphere of the earth, are in number but *two*, viz. the *positive* or solar, which has its commencement with the increase in the length of the *day,* immediately after the period of the winter solstice, and its termination, relatively, with the increase in the length of the day, immediately after the period of the summer solstice;—and the *negative* or planetary tide, which commenees with the

increase in the length of the *night,* immediately after the period of the summer solstice, and terminates with that of the consecutive increase in the length of the night at the period of the winter solstice. Thus, it will be perceived, that these opposite electrical tides, which, as stated, induce in each of their revolutions that of the seasons;—commence *by minor,* and thence go on continually increasing as they progress, till, finally, they terminate in *major* degrees of force:—each, in the order of its progression, exhibiting a *graduated scale* of action from its commencement at 1°, to its termination, at—suppose—100°.

Again, each of these electrical tides in its action on the atmosphere, converges to, and diverges from *a main focus,* where this its action is most powerful; and from the position of the main focus of the positive electrical tide being situated between the tropics —to, and from which, its collective action on the entire of the *eastern,* but more particularly, owing to the angle formed by the axis of the earth with the plane of the ecliptic—on that of its *summer hemisphere*, as stated, continually, converges and diverges. —The force of this action from the centre, or main focus at the tropic, in the direction of the pole of the summer hemisphere, other circumstances being the same, is, as the inverse ratio of the distances. And hence, as in the preceding case which refers to the period of its duration;—the *relative force* of

the positive or solar electrical tide *at the same time,* along the ascending parallels of the same or summer hemisphere, exhibits,—equally as in its advance—the spectacle of a finely graduated *scale of action;* its highest degrees being at and in the vicinity of the tropic; and its lowest,—(were it not for the approximation in the relative effects on the temperature, which the difference in the circumstance of time or *length of exposition* to the solar action during summer which subsists between the lower and higher latitudes,)—at and in the vicinity of the pole. It follows, from this double disposition, i. e. as refers to the circumstances of *time* and *distance,*—that with the gradual increase of its force, the solar tide, as it progresses on the scale of its duration from its commencement onwards to the period of its termination, has the effect of inducing changes in the temperature and other phenomena of the atmosphere, corresponding thereto, along the graduated scale of *distance* from its main focus between the tropics, to the pole.

Again, during the period this the positive or solar tide is progressing in the summer hemisphere, the *negative,* or planetary electrical tide, is similarly progressing in the opposite or winter hemisphere of the earth; dissimilar, however, from the positive, the *main focus* of the negative tide is situated at the pole of the latter; but, notwithstanding that its action on the temperature and other phenomena of

the atmosphere is altogether the reverse of the positive tide, this the negative action of the earth in winter is, in other respects, or as regards the circumstance of *time,* and of *distance* from its main focus, governed by exactly the same laws in its development as the positive or solar tide. It follows, consequently, that the action of this the negative tide in the annual circle being always greatest at its main focus at the pole, and least in the lower latitudes of this the winter hemisphere,—it gradually lessens in its relative amount or force with the distance of places from its main focus,—other circumstances being the same; and that with, and in proportion to the progression of this tide from the period of its setting in to that of its termination, similar to its opposite, the *positive,*—it induces changes corresponding to those of the gradual augmentation or increase in its force, whether in the temperature or other phenomena of the atmosphere, along the graduated scale of its action from the pole to the tropic. Now, at the *solstice,* or period of the setting in of both these electrical tides in the opposite hemispheres of the earth, and commencement of their advance on the graduated scale of *time,* or progression;—suppose at this period the action of either tide at its main focus as 1°, and gradually less in proportion to the distance of places from the latter, whether in ascending or descending the opposite scales of latitude, according to the season; it

will follow, that, in proportion as from the period of its commencement either tide progresses, the force of its action, which at this period was as at 1° at its main focus, will shortly be transferred to the distance of some degrees *north,* by the *positive,* and some degrees *south,* by the *negative* electrical tide, (if the theatre of these actions be our northern hemisphere,) from these their main foci, on the opposite or ascending and descending scales of latitude; such primary degrees at either main focus, being as constantly succeeded by others *more intense.* And that a similar change, locally, in the relative amount of the action of either electrical tide along these the opposite scales of latitude, will continue to take place throughout the entire period of their progression,—a weaker action in each parallel or division of these scales of latitude, being, as the tides advance, continually succeeded by a stronger; and that the entire of these changes of action in either hemisphere will continue to progress simultaneously. And thus, that a *consecutive transfer of the same degree* of the action of either force, from the period of the commencement to that of the termination of these electrical tides along the opposite scales of latitude, will take place.

Further, the action of either electrical tide on the temperature and other phenomena of the atmosphere, as assumed, being derived from, or an effect, of its *reflection* by the surface of the earth beneath;

and the latter in its composition, or the surface it presents; varying, as it does, considerably, in this its power, as a *reflector*. Thence the circumstance, as refers to the relative force of either tide in the annual circle,—that, the latitude or distance from its main focus being the same, a further variation, relatively, in the amount of its action on the temperature, &c., proportioned to such difference of force in the reflecting surfaces, is induced. To which latter circumstance, as assumed, is chiefly to be ascribed all those peculiarities of *climate* so frequently observable in neighbouring countries lying within the same parallels.

Again, the setting in of either electrical tide of the annual circle at the period of the solstice, does not check, or in any way suspend the opposite action in the hemisphere where it occurs; but, on the contrary, the opposite electrical tide being then at the period of its termination, as regards its progression or *consecutive increase*, is at its *maximum*, as the commencing tide, at its *minimum of force*:—and thus, other circumstances being the same, the former continues to be the *dominant* action on the atmosphere, thence, to about the period of the ensuing *equinox*: when, as their *times* in the diurnal circle, the relative forces of the opposite electrical tides, collectively, on the entire atmosphere of the earth, are equalized one to the other. From this it follows, that, together with the action of either elec-

trical tide of the annual circle being continually blended with the action of its opposite, by the ordinary revolutions taking place in the diurnal circle,—it is not till after the period of the ensuing equinox, though having its commencement, as stated, at the solstice, that the *progressing tide* acquires, collectively, an ascendency of force over its opposite. And thence the further division of either electrical tide of the annual circle into, what in our theory is denominated a *transition*, and a *progression season*, or quarter. The first or transition quarter extends from the solstice to the ensuing equinox, which marks the retrogression or decline of the preceding or dominant electrical tide, from its maximum, to the period of its equalization with the action of its opposite: and the latter or progression quarter extends from the equinox to the ensuing solstice,—so called from its being the period of the consecutive *ascent* of the progressing tide over the action of its opposite. Thus, it will be perceived, that the proportion of the annual circle described by each of its electrical tides, presents the spectacle of the opposite and corresponding section of a circle; they being each the exact counterpart of the other, whether in the manner of their progression, or natural divisions, &c.; and which, combined, constitute the annual circle, comprehending within it, as stated, one entire revolution of the seasons.—Such being, as assumed, a sketch of the

ground plan on which nature has based the edifice of her operations in reference to the vital principle of temperature, and the other local atmospheric phenomena, not alone of the earth, but of the whole of the planets of our system; and which, from the nature of the subject, I thought it necessary to treat of separately, before entering on the difficult but important subject of the *lunar action* on the temperature and other phenomena of the atmosphere.

Lunar circle. The lunar circle of electric action on the atmosphere partakes in all respects of the nature of the action of the primary electrical and magnetic forces in the annual circle, as described; but dissimilar from the latter, each lunar circle consists of, and consequently is divisible into *two positive* or solar, and *two negative* or planetary electrical tides. The periods of the setting in, as of the termination of these tides, or rather of their *visible effects* on the weather, vary occasionally with the changes of electric action in the annual circle; the periods of their most visible and equal action on the weather, as on the tides, being at or about the equinoxes; and of their greatest irregularity on the weather, as on the tides, those of the solstices. The former, or positive lunar tides, commence three days previous to, and continue during the three days which follow the periods of the *syzygies,* or new and full moon; and the opposite or negative lunar tides commence three days before, and continue three

days after the periods of the lunar *quadratures*, or first and third quarters of the moon. The intermediate periods of the lunar month which connect the termination of each tide with the commencement of that by which it is succeeded, are by some denominated *octants*, and in our theory *intercalary* periods; during which a partial suspension of the lunar action on the atmosphere, marked by a temporary change of wind, and occasionally of the weather, is usually observable. Further, each lunar tide, similar to those of the annual circle, commence by *minor*, and thence to the periods of their termination progress to *major* degrees of force. But here may be said to cease any further analogy between the lunar action on the atmosphere and that of the opposite primary electrical forces in their respective tides in the annual circle, as described. For, whereas the action of these forces respectively in the annual circle, shows a continual increase or decrease during six months consecutively; the lunar action, on the contrary, with almost the sole exception noticed of the increase in the force of its tides as they progress, exhibits the spectacle of an action *always uniform in its amount* in this, that it is the same at the solstices as at the equinoxes, and at the poles as at the tropics. This peculiarity is necessarily an effect of the lunar action, as contrasted with the action of the opposite primary electrical forces in the annual circle, being an isolated or *distinct agency;* and consequently removed

beyond the influence exercised by the *local action* of the sun and earth on the atmosphere.—The lunar action in this respect being perfectly analogous to that exercised by the superior and inferior planets on the temperature and other phenomena of our seasons. But,—however powerful and influential,—owing to the continual change going on in the relative action of the opposite primary electrical forces in the annual circle;—their total opposition in point of effect one to the other at the periods of the opposite solstices, inducing at each change a corresponding change in the effect of the lunar action on the weather;—the influence, sometimes extraordinary, on the temperature and weather, exercised by certain classes of *localities;* combined with the total absence of correct data in reference to the nature and source of planetary temperature:—thence, I say, the obstacles always opposed to those who, up to the present, have attempted a solution of the important problem of the lunar action on the weather:—insomuch that, notwithstanding the palpable effects of this action on the more ponderous element of water beneath, the existence of a lunar influence on the atmosphere and weather has been not only doubted, but denied.*—That,—owing to the contradictory effects of the lunar action on the weather

* "The common opinion," says a writer in Rees's Cyclopædia, art. *Moon,* "as to the influence of the moon on the changes of the weather, though very ancient, is now generally exploded by philosophers."

at different seasons, and in the vicinity of local influences of opposite tendencies on the temperature and weather during the same seasons, and in the absence of correct data,—any other than such conclusion should have been come to by philosophers, might well excite our surprise. For, considering the amount of these apparent anomalies in the lunar action on the weather arising from the circumstances noticed, it were impossible to come to any other conclusion. But it being my object in the following pages, by embracing in a general view the various concurring causes which exercise an influence on the temperature and weather, to point out the sources in which the anomalies in reference to the lunar action on the latter have their source; and to show, amid the former, the important place it holds; and that it were but anticipating our subject to enter further on the discussion of these matters in this place,—I shall pass to the first or leading circumstance, which, throughout the year, chiefly determines the nature of the lunar action on the weather.

Various TENDENCY *of electric action in the atmosphere at various periods, connected with the changes of the seasons in the annual circle.*

Considering the atmosphere as the theatre, and the annual circle of electric action as forming the

coercing limit, within which the periodical revolution always progressing between the elements of water and air attached to the earth, on which the principle of their salubrity depends, takes place; and, that the upholding of this revolution may be said to constitute the basis of the entire dispositions of nature in the physical world, to which the variations in the temperature of the atmosphere and in its other phenomena should be considered but as accessory or incidental,—the redundance of the electrical aeriform bases of the atmosphere being continually returned from it in rain, and their place in its body as regularly supplied by the decomposition induced by the *direct* species of electric action—solar and planetary—of the element of water beneath:—the medium or means by which this revolution, as regards the atmosphere, is carried on, being various modifications of the chemical principle of *simultaneous fixation and development;*—as *drought* and *humidity* may be esteemed the opposite levers by whose alternate action,—similar to the pendulum,—this change in its body is effected; and in which the variations of its temperature and other phenomena have their source.—And as the alternations of electrical action on the atmosphere, solar and planetary, by which drought and humidity are induced, are common to each of the *local circles,* but are more strongly marked in the lunar than in the diurnal, as in the annual circle than in the

lunar,—proportioned to the superior magnitude and more powerful development of electric action in the former than in the latter, or in the diurnal circle.— Thence, I say, it follows, that at every period of, or throughout the annual circle,—agreeably to the phenomena incident to the part of this revolution progressing at the time,—there is a particular tendency or *determination* of electric action in the atmosphere, whether to *drought* or *humidity*, to which its other phenomena, or those of an opposite nature, are, as regards the weather generally, but exceptions. These exceptions being usually effects which result from the opposite action for the time being, of the moon, and of the conjoint influence exercised by the localities where they occur, in their production; and consequently, may serve as guides in pointing out the important part throughout the year exercised by these agencies. Thus, there being necessarily, at every period of the year, a relative determination in the atmosphere to a particular species of electric action; and that an attention to this circumstance, varying as this tendency does with the season, supplies the surest clue in reference to ascertaining in advance the approaching changes in the phenomena of the atmosphere and weather, I shall point them out as succinctly as the nature of the subject will allow. And as constituting, other circumstances being the same, the *ground* of the action of the opposite primary electrical forces in

the annual circle throughout the year, I shall commence with the period of the *winter solstice.*

Immediately after the winter solstice, when, with *the loss of their ground of projection* in the annual circle, the lunar changes lose much of their effect in originating rain,—combined with the increasing concentration of the negative action of the earth at this period, incident to the increase in the length of the day; and, if not before, the consequent setting-in of frost in the higher and middle latitudes,—the determination of electric action in the atmosphere for some time, proportioned to the nature of the season and localities, is to the *direct species* of this action, and to drought. The regions where this rule proves an exception being those of the lower latitudes, where frost but rarely occurs; to which may be added our own skies during very mild winters, when the tendency throughout this period is to rain, and its accessory phenomenon storm. Towards the commencement of February, in ordinary seasons, a change in the determination of electric action from the preceding, usually takes place, i. e. to the *inverse species* of this action, and to rain;—being an effect of the increased force of the solar action, aided in certain localities, as in our skies, by the radiation of heat from the waters of the sea. This tendency being connected with the periodical *transit* of temperature, or its ascent above the mean temperature of places, and with

the equinoctial phenomena in spring, continues during the copious rains of February and beginning of March, up to the restoration of the equilibrium of electric action in the body of the atmosphere at the termination of the equinoctial phenomena and setting in of the *north-east* wind.

With the setting in of the north-east wind in spring, as a *periodical,* may be said to date the commencement of the summer *progression season;* and with it commences, and for a longer period than before, a change of determination in the atmosphere to drought and heat:—which latter becomes more confirmed as we approach the summer solstice; and thence continues to the period of the highest degree of summer heat in July or August, according to the season and latitude of places. Such, it may be observed, is the determination of electric action *generally,* in the atmosphere of our hemisphere during this period; but such is the influence of *locality,* at times, on the phenomena of the atmosphere, that in the countries situated within the same parallels as these islands,—an exception to this rule takes place, i. e. in the *periodical rains,* which, in ordinary years, succeed the period of the north-east wind, and, not unfrequently, with but little intermission, continue till towards the period of the autumnal equinox:—these rains, in amount and continuance, being usually lighter and of shorter duration, in proportion to the greater heat of the

summer, and *vice versá*. These periodical rains, as noticed, have, as assumed, their source in the local position of these countries, in reference to those situated at the opposite extremes of our hemisphere on either side;—being consequent on the superior force of the solar action on the latter; arising, as regards those lying to the north of us, from their greater exposition at this period to the solar action, with the increased length of their day; as from its greater influence on the countries south of us, owing to their greater proximity to the tropic and circle traversed by its main focus. This more powerful action of the sun during summer on the opposite extremes of our hemisphere, than on its centre, having the effect of concentrating on the latter, or intermediate regions, the opposite or *negative action* of the earth and moon; which, proportioned to its amount, thus develops itself in our skies. From these premises, it will follow, that these rains, at this period of the year—in the form of a belt—traverse the entire of the temperate zone of our hemisphere; and necessarily embrace a wider range at their commencement, which the increasing heat with the advance of the season gradually contracts. These rains on seasons when the solar action is more than usually powerful, at length narrow in their range, even in the vicinity of the sea, where they continue longest; and finally disappear about the middle of July, or period of *St. Swithin*,—sometimes later. This will account

for the apparently anomalous circumstance so frequently noticed in the papers, viz. the co-existence, during summer, of continual drought in Sweden and other northern countries, with continual rains in England, France, &c. And, as the relative force of concentration of the negative action of the earth in our skies in summer, which induces these rains, is usually proportioned to the greater or less intensity of the cold during the preceding winter; thus it is that finer summers usually follow after mild, than severe winters.

The period of the highest degree of summer heat being passed, a change of determination to humidity and rain, as after the lowest degree of winter cold at the opposite period of the year, shortly takes place; bringing in its train the heavy rains of autumn, incident to the *first stage* of the dissolution of the *calorific condensation* in the inferior region of the atmosphere. This change—with the passing of the highest degree of summer heat by which it is preceded,—necessarily occurs much earlier in the higher, than in the lower latitudes; and, other circumstances the same, in the vicinity of the sea and of mountains, than in the interior of continents.—But, as we approach the period of the autumnal equinox, this determination to rain is gradually succeeded by a species of *neutral period*, during which there does not appear to be any decided tendency of electrical action in the atmosphere

to either species—*direct* or *inverse,*—owing, possibly, to the near approach at the time, to an equilibrium between the actions of the opposite primary electrical forces of the sun and earth, as between the relative amount of their opposite aeriform bases in its body. During this period, the influence of the lunar action on the weather is, in general, strongly marked;—inducing at the periods of its changes—whether *positive* or *negative*—slight rains; and towards the termination of the lunar tides, from the increased force of the lunar action,—drought, and corresponding rises or falls of temperature, agreeably to the nature of the tide.

To this neutral period shortly succeeds that of the autumnal equinoctial phenomena; during which, as in spring, the tendency of electric action in the atmosphere is to rain; inducing with the latter the accessory phenomena of storm, &c. And, finally, about the beginning of November, in our latitudes, the *winter progression season* sets in; during which, from the continually increasing force of the negative action of the earth, the determination of electric action in the atmosphere is to rain. This the negative action of the earth acting on the remains of the *calorific base* in the inferior region of the atmosphere; thus inducing in the middle and lower latitudes succeeding intervals of rain and storm, to the period of the winter solstice:—the accessory phenomena of storm, &c. increasing in force, other circum-

stances the same—with that of the *contrast* between the action of the opposite primary electrical forces in the annual circle, and advance of its negative electrical tide, to the period of its conclusion and lowest degree of annual temperature.

It may be right to observe, that, as relatively the inverse species of electric action in the atmosphere and rain, is but as the *exception,* whereas the opposite or *direct species* of this action is to be considered the *rule;* that it by no means follows,—even during the periods noticed as being those in which the determination of electric action in the atmosphere is to rain, that the whole, or even major part of these periods is a continuance of rain. But simply, as contrasted with the other parts of the year, that during those intervals the preponderance of rain is, at once, more generally and strongly marked, than during the others, in the weather. And further, it being, as stated, of the nature of electric action in the atmosphere—of whatever kind—to commence by minor, and thence to progress continually to major degrees of force. That this rule will be observed to hold good in regard to the *determination* of electric action, as noticed, to a particular species, during each of the intervals indicated in the annual circle:—they, (the drought, as the extreme degrees of summer heat and winter cold incident to the actions which induce them,) will, according to the season, be found to be

more decided towards the termination of the periods in the annual circle assigned to them, than at their commencement;—and, in like manner, as regards the opposite or rainy intervals.—These rains, with their accessory phenomena,—(only excepting the four periods of the annual circle at which the *chief crises* of electric action in the atmosphere occur, hereafter to be noticed,)—will be found to go on increasing, from their commencement to their conclusion, whether in quantity or violence.

Chief MOTEURS, *or agencies, which throughout the year exercise a preponderating influence on the weather: together with the changes that take place between them.*

According to our theory, the phenomena of the atmosphere—whether as connected with the principle of temperature or otherwise, being considered as the necessary and consecutive results of physical causes;—the object of the present article is to show, that, as these the causes which govern the phenomena of the atmosphere and weather vary with the season, and not unfrequently, with the nature of the locality of places,—that at every period of the year there exists a principal or preponderating cause in reference to these phenomena, to which, during the period of its domination,—other concurrent causes are more or less subordinate and secon-

dary. And as, in order to a suitable acquaintance with our principles, both the number and important influence, assumed to be exercised on the temperature and weather throughout the year by these agencies, requires to be noticed under this point of view; I shall, with all possible attention to brevity, proceed to do so.

The primary causes which throughout the year preside over the atmosphere and phenomena of the weather, are, as stated, the positive electrical action of the sun, and the negative electrical action of the earth;—the positive and negative electrical action of the moon;—and, finally, as being derived from *reflective action*—the influence exercised on these phenomena by local causes, or what in our theory are called *localities*. Thus, it will be seen, that these causes are divisible into three classes, of which the first and most influential is that of the active forces of nature in the annual circle; which, though of the *same kind*, are *sexual*, or divisible into opposite species:—that, whether, in the annual, the lunar, or diurnal circle of the action of these forces on the atmosphere, these opposite species succeed each other alternately by a series of impulsions or tides, the length or duration of which, is, necessarily, proportioned to the relative magnitude of the circles to which they belong;—and that the action of these tides, both in the annual and lunar circles, are continually blended by the revolutions of the diurnal

circle; which action, finally, in each circle, commences by minor, and thence progresses to major degrees of force. From the latter circumstance, it will appear, that, as refers to the annual circle, its opposite electrical tides can only approximate one to the other, twice a-year, in the relative amount of their forces on the atmosphere, viz. at or about the periods of the equinoxes;—and, consequently, that during the remainder of the annual circle or year, the agency of the active forces of nature in these tides, is divisible into a *superior* and *inferior*, or a *dominant* and *retrogressive* action. The difference, relatively, between the force of these opposite actions on the atmosphere, as refers to the annual circle, being, in general, determined by that of *their times* in the diurnal circle; and by the relative *distance* of places from their main foci.

The second class of these agencies, both in point of importance and effect, are the lunar actions—*positive* and *negative*—which, as in the annual circle, succeed each other alternately: but which, as noticed in a preceding article, dissimilar from the actions in the latter, are, with certain exceptions, always relatively, of equal force;—and thence, consequently, are indebted for the difference, in their effects on the weather, to the changes continually taking place in the *ground of their projection*, i. e. the relative force, consecutively, of the opposite actions, solar and planetary, in the annual circle;—

which, being never precisely the same during two consecutive local tides of the same name, causes that the latter cannot, in any particular location, at any time, be productive of exactly similar effects on the weather.

In reference to the third class of these concurrent causes, incident to the action of the opposite primary forces on the atmosphere being a *reflective* action,—it necessarily consists, in the first place, in the difference subsisting between the *land* and *water* surface of the earth;—and, secondly, between *mountains* and *extended plains*, as *reflectors*. These opposite classes of reflectors or *localities*, varying, necessarily, in their effects, whether on the temperature or weather,—similar to those of the plates in an electrical battery,—with the variations in their superficial contents. But the subject of localities being treated of under a separate head in the subsequent pages, it will be sufficient for our purpose at present to observe, that the effects on the temperature and weather which result from the difference of force subsisting between the reflective surfaces beneath, hold even pace with the increase of force in the existing dominant action in the annual circle, as from either equinox we approach the solstices and opposite extreme degrees of temperature by which they are succeeded. And that, after the latter periods, these the effects of localities again decrease as we approach the equinoxes; till, at the latter

periods they may be said almost wholly to disappear. A further circumstance may be noticed in reference to this class of concurrent causes, as contrasted with the action of the opposite primary electrical forces in the annual and lunar circles, viz. that, whereas the latter actions are more particularly connected with the changes of temperature, the influence of localities is more particularly connected with the changes which take place between the *opposite species* of electric action—*direct* and *inverse*—in the body of the atmosphere, in which the changes of weather, from humidity to drought, and *vice versâ*, have their source.

Thus, in these three classes of concurrent causes, and in the disposition observable between them, as stated, would be found the *moteurs* or preponderating influences which throughout the year govern the phenomena of the atmosphere and weather, were it not for the change of position which half-yearly takes place in the main focus of the negative action of the earth from the pole of its approaching summer, to that of the approaching winter hemisphere, at, or about the periods of the equinoxes.—In which change of position in the main focus or action of a force which, throughout the year, divides the empire of the weather with that of the sun, and in the new direction thence given to this action throughout the entire body of the atmosphere,—will be perceived an additional *moteur* to those enume-

rated; and one, it will be admitted, amply adequate to the production of those remarkable phenomena—the *equinoctial gales.* The latter phenomena, as assumed, being effects arising from the loss of the pre-existing equilibrium of the negative action of the earth in the body of the atmosphere, till it is again restored in the opposite direction thus given to it.

Thus, to commence with the year or winter solstice—as constituting the existing ground of the temperature from the latter, to the period of the setting in of the equinoctial gales in spring,—the negative action of the earth, in its connexion with the lunar action, continues to be the chief *moteur* of the weather. From the commencement of the equinoctial phenomena,—connected as they are in spring with the transit of temperature in its annual ascent,—to the period of their conclusion at the setting in of the north-east wind as a *periodical,*—the chief *moteur* or agency which sways the phenomena of the atmosphere, is, in its connexion with the lunar action, the change of direction which at this period takes place in the collective negative action of the earth from one to the other of its poles, as stated. From the conclusion of the latter or vernal equinoctial phenomena, to about the period of the summer solstice, the chief *moteur* of the weather is the lunar action. The latter continues to be the chief *moteur* till it merges in the increasing force

of the solar action, or becomes blended in the cause which, as stated, induces in the central parallels of our hemisphere, the *periodical rains* which in the commencement of summer succeed the north-east wind. These rains, it may be remarked, particularly in insular situations, such as England and Ireland, frequently commence before the summer solstice.—And, as connected with our subject,—having observed, in treating of the lunar circle, that the periods of the year when the lunar action was most apparent and influential on the temperature and weather, were those likewise in which it was most conspicuous on the *tides*, and *vice versâ*;—as demonstrative of the principle in which the tides have their source, being altogether identified with that of the lunar action on the *temperature*,—as stated in the theory of these phenomena, published by me in the "Rudiments of the Primary Forces," &c., already alluded to;—I shall only add, that if any one can produce a proof equally conclusive, as to the correctness of any other theory of the tides that has hitherto appeared, I shall freely give up all pretensions to credit, in reference to that published by me:—but the thing is impossible.—To resume:—from the period of summer when, from its increased force the positive action of the sun has acquired such an ascendency over the lunar action, as that, for the greater part, the latter becomes therein and lost sight of, on to the period

towards the commencement of autumn, when, by the increase in the length of the night, the negative action of the earth, blended with the lunar action, becomes so considerable, as to bring on the first great break in the season—and the heavy rains at this period incident thereto,—the solar action continues to be the chief *moteur* of the weather. It being, as observed, the latter action, which, during the prevalence of the periodical rains of summer in the central parallels of our hemisphere, by the concentration of the negative action of the earth in the skies of these parallels, is the cause even of these rains. In proportion, however, as with our approach to the period of the autumnal equinox, that the opposite actions of the sun and earth in the annual circle become more equally balanced than during summer, one to the other,—the lunar action again acquires an increased ascendency over the latter;—and thence to the period when anew, by the change of position in the main focus of the negative action of the earth, that this change induces its accustomed phenomena,—the lunar action is the chief *moteur* of the weather.—From the period of the setting in of the equinoctial phenomena in autumn, connected with the transit of temperature in its annual descent—owing to the influence exercised by the main focus of the negative action of the earth on the atmosphere—as in spring—being superior to that of the moon;—this influence, during the con-

tinuance of these phenomena becomes anew the chief *moteur* of the weather. And finally, from after the period of the autumnal equinoctial phenomena, to near that of the winter solstice when it merges gradually in the increasing force of the negative action of the earth,—the lunar action becomes again, the chief *moteur* of the weather.

Now, taking into account the consecutive decrease or falling off of force in the action of either of the primary electrical forces, solar or planetary, during the periods of their respective domination in the annual circle, on the scales of their extension, formed by the ascending or descending parallels of either hemisphere, proportioned to the distances of places from the circles traversed by their main foci:—it will be seen that neither of these actions during the period of its domination can become the chief *moteur* of the weather on the different parallels of the same hemisphere, *at the same period of time;* but that this its domination, in both cases, will commence first in the vicinity of its main focus, whence, with the advance of the season it will gradually extend itself over the regions lying more distant, till at, or subsequent to the solstice, its domination will become established over the atmosphere of the entire hemisphere. And, as being a necessary consequence of such a disposition in the action of the primary forces in the annual circle, that in those regions of either hemisphere which lie the most

distant from the circles traversed by their respective main foci, and where they are the latest in attaining to a certain degree of domination,—there it is, in our approach to the solstices, where the lunar action will be longest, the chief *moteur* of the weather, and *vice versâ*. And as those localities, whether in winter or summer, which co-operate most in originating rain in their atmospheres, are those likewise where the lunar action during these seasons continues to be most influential on the weather; thus it is that, after the lunar changes in summer have ceased to induce any visible effect on the weather in the interior of continents and extensive plains, that they still continue to produce their accustomed effects in the vicinity of the higher ranges of mountains,—as during winter in the vicinity of the sea.

However, notwithstanding the chief *moteur* throughout the year, as indicated, is that which, during the period of its domination, exercises the greatest influence on the weather, this does not *suspend* the influence of *secondary causes;* but, on the contrary, they act conjointly with the former, and thence, though in a secondary degree, contribute towards the development of the passing atmospheric phenomena of the day. Thence it is, that during the solstitial seasons, when either the dominant action of the sun in summer, or negative action of the earth in winter, is the chief *moteur*,—that

such action in the annual circle, has the effect of merging to a certain extent that of the moon ; and, as being a consequence of the latter, that its opposite actions, *positive* and *negative,* are thence, not unfrequently, *blended* in the weather ;—that notwithstanding such blending, the lunar action which at the time is *in opposition* to the existing dominant action in the annual circle, is that, during which,—as being in the order of their occurrence,—will be found to occur the most powerful development of the violent class of atmospheric phenomenon in either season, except only, as will sometimes happen, where the peculiar nature of the locality reverses this order. I may add, that a similar connexion as this noticed of the lunar action with the violent class of atmospheric phenomena, will be found equally apparent during the prevalence of the equinoctial gales in spring and autumn. For, though after severe winters these phenomena in spring will usually be found to occur during the *positive* lunar tides, as after mild winters during the opposite or *negative* lunar tides ; and so in autumn, agreeably to the nature of the preceding summer ; yet, at either season, these phenomena will not be found to occur *indiscriminately* during the positive and negative lunar tides ; but if they set in with the negative tide, there will be a suspension of them during the succeeding positive tide ; and again, a recommencement of them in the following negative

tide, and *vice versâ.* And thus it is that even during those periods of the year when the lunar action is not the *chief moteur;* it, notwithstanding—when understood—supplies an unerring guide in reference to ascertaining in advance the periods of occurrence of the most remarkable atmospheric phenomena throughout the year.

SUSTAINING *and* ACTING *Circles of Electric Action.*

In contemplating the spectacle presented to us by Nature in her physical creations, it is impossible not to be impressed with the conviction that nothing therein has occurred by accident; but on the contrary, that *design* has always preceded *execution.* This will become manifest from the circumstance that in following the dispositions of nature in the material world, she will, in all cases, be found commencing her operations by first establishing a *basis* or sustaining ground on which they are to depend; and from which, to extend and develop themselves.

Thus, with regard to the vegetable kingdom, nature commenced by encrusting the earth with a *soil* adapted to the fruition and sustenance of plants. And having thus established the vegetable, she in turn made it the basis of the animal kingdom;—commencing her operations in the latter—as ap-

pears from the researches of Baron Cuvier, and others—so as to make the greater part of its inferior members a sustaining ground for those which rank higher in the scale of excellence; and finally—after these preliminary dispositions had been completed—concluding her labours in this department by the creation of man!—thus making the entire of her previous operations in both these kingdoms subservient, or in some sort necessary to her intended production of a creature so superior, and so variously gifted.

And if from the latter we turn our attention to the elemental operations in the mighty ocean of air by which our earth is, on all sides, surrounded, and which, together with supplying the medium of their vitality to both the animal and vegetable kingdoms, constitutes the matrice and alembic of those active forces by which the principle of movement in the mighty machine, is eternally upheld and perpetuated;—notwithstanding, I say, the immensity of its extent, its impalpability, and extreme elasticity, which seems to defy control in regard to the evanescent changes continually taking place in its body; yet, when analysed, we shall find that here, equally as in the more material of her creations, Nature is consistent with herself, as her dispositions in reference to the atmosphere will be found based on, and strictly conformable to system.

Further, the *circle,* properly speaking, should be considered the type of nature in this, that *revolu-*

tion is the principle on which is based at once the renovation and perpetuation of her institutions. This, necessarily, obliges her in all cases to have recourse to, and institute *opposite agencies*, by whose alternate or reciprocal action only, it were possible to uphold this the principle of revolution. For the action of a *single agent*, however efficient, as it could only operate in *one way*, or in a particular direction, *ad infinitum*;—*revolution*, which, as stated, requires the reciprocal action of opposite forces to effect, could never be accomplished by a single agency. Thence the necessity of *divisibility* in all the primary forces of nature, as recognised by our theory, into *sexual* or opposite kinds; and of the further divisibility of electric action in the atmosphere into opposite species,—*direct* and *inverse*,—by the alternate occurrence of which, consecutively, consequent on the alternations in the action of the opposite primary electrical forces—solar and planetary—in the three circles of their movement thereon,—the principle of revolution is induced between the elements of water and air attached to our earth: and its progression thus continually upheld and perpetuated. And as these the opposite species of electric action in the atmosphere are in all respects opposed one to the other;—and, as a consequence of the latter, that the *disposition* in reference to the action of the primary electrical forces in the three local circles of their movement

periods they may be said almost wholly to disappear. A further circumstance may be noticed in reference to this class of concurrent causes, as contrasted with the action of the opposite primary electrical forces in the annual and lunar circles, viz. that, whereas the latter actions are more particularly connected with the changes of temperature, the influence of localities is more particularly connected with the changes which take place between the *opposite species* of electric action—*direct* and *inverse*—in the body of the atmosphere, in which the changes of weather, from humidity to drought, and *vice versâ,* have their source.

Thus, in these three classes of concurrent causes, and in the disposition observable between them, as stated, would be found the *moteurs* or preponderating influences which throughout the year govern the phenomena of the atmosphere and weather, were it not for the change of position which half-yearly takes place in the main focus of the negative action of the earth from the pole of its approaching summer, to that of the approaching winter hemisphere, at, or about the periods of the equinoxes.—In which change of position in the main focus or action of a force which, throughout the year, divides the empire of the weather with that of the sun, and in the new direction thence given to this action throughout the entire body of the atmosphere,—will be perceived an additional *moteur* to those enume-

rated; and one, it will be admitted, amply adequate to the production of those remarkable phenomena—the *equinoctial gales*. The latter phenomena, as assumed, being effects arising from the loss of the pre-existing equilibrium of the negative action of the earth in the body of the atmosphere, till it is again restored in the opposite direction thus given to it.

Thus, to commence with the year or winter solstice—as constituting the existing ground of the temperature from the latter, to the period of the setting in of the equinoctial gales in spring,—the negative action of the earth, in its connexion with the lunar action, continues to be the chief *moteur* of the weather. From the commencement of the equinoctial phenomena,—connected as they are in spring with the transit of temperature in its annual ascent,—to the period of their conclusion at the setting in of the north-east wind as a *periodical*,—the chief *moteur* or agency which sways the phenomena of the atmosphere, is, in its connexion with the lunar action, the change of direction which at this period takes place in the collective negative action of the earth from one to the other of its poles, as stated. From the conclusion of the latter or vernal equinoctial phenomena, to about the period of the summer solstice, the chief *moteur* of the weather is the lunar action. The latter continues to be the chief *moteur* till it merges in the increasing force

of the latter many degrees beyond what, under the previous disposition of the lunar and annual circles, the action of the existing dominant force in the latter circle could have carried it to,—circumstances of latitude and locality being the same. I shall add, that it was the remarkable change which I so often had occasion to remark in the weather immediately after the periods of the solstices, from what it had been immediately before,—including the irregularity in the occurrence of the violent class of atmospheric phenomena in reference to the lunar action, thence to the periods of the succeeding equinoxes;—and, at the same time, the, in general, regular occurrence of the violent class of atmospheric phenomena during these intervals of the annual circle, in the *diurnal circle*, as connected with the *lunar*,—which first called my attention to the fact, and satisfied me, as to the divisibility of these the *local circles*, into what I have denominated *sustaining*, and *acting circles*;—and which, by reason of the change in this respect that takes place between these circles at the solstices, has the effect of inducing the necessary *separation* of the *direct* from the opposite or *inverse* species of electric action in the atmosphere, for the important purpose noticed.

From these premises, it will follow that, from, or shortly before the equinoxes, to the periods of the solstices, the *annual circle* constitutes a sustaining

ground to the *lunar action* on the atmosphere; and during which, as regards the weather, the lunar is necessarily an *acting circle*:—as, in its turn, the diurnal circle is to the lunar. And, consequently, that these are the periods of the year,—particularly at their commencement—when both the opposite species of electric action in the atmosphere, as the rises and falls of temperature, with those of the tides, incident to the changes in the lunar action, occur with the greatest regularity, i. e. *in the order of their occurrence* in the lunar and and diurnal circles. And that, with the loss of its sustaining ground in the annual circle,—from the solstices to the periods of the ensuing equinoxes, are those periods of the annual circle during which the opposite species of electric action in the atmosphere are *the least regular* in their occurrence in reference to the lunar action. But that,—notwithstanding this irregularity in reference to the lunar action, as the lunar circle still continues to be a sustaining ground to the *diurnal*,—the occurrence of the opposite species of electric action in the atmosphere in the latter circle, as connected with the former, will, in general, be found to be regular; or according to the order in which they should occur:—it may, however, be added, that such regularity will be more particularly conspicuous after an interval of fair weather, than at any other time.

THE WEATHER, *as connected with the* ANNUAL CIRCLE.

Having in the forgoing pages detailed and explained the leading principles and assumptions of the present theory,—we are now arrived at the part of our subject which must prove their test, and, consequently, to that part of it which is at once the most difficult, as the most important to do justice to, viz. the application of these principles to ascertaining *in advance* the nature of the approaching seasons and changes of the weather. For, as observed by a French writer on meteorology, "il est bien plus facile d'établir des théories et de rassembler des principes, que d'en *déduire des applications plus ou moins immédiates.*" Ay, this is, indeed, the point, which, either to surmount or reconcile, has proved so entirely futile and abortive in all preceding attempts of the kind; and which, consequently, as regards all practical purposes of utility, has left meteorology, as a science, so long stationary, or nearly in the same state of backwardness as when it first begun to engage the attention of men of science:—from which, it may be added, it was impossible it could have advanced without the aid of the discoveries which have led to the present theory. But to resume, by a short recapitulation of our principles:—the action of the opposite primary electrical and magnetic forces on

the atmosphere—solar and planetary—in the local circles of their movement—diurnal, lunar, and annual,—being, as stated, alternate, and by a succession of impulsions or tides of shorter or longer duration, proportioned to the relative magnitude of these circles.—And electric action in the atmosphere being of opposite species—*direct* and *inverse*—whose occurrence, as the action of the primary electrical forces, is alternate:—each of these species has appropriated to itself a particular region of the atmosphere, which serves more particularly as the theatre of its development,—the *direct* species of this action having for its theatre the inferior region, or that next the earth's surface; whereas the *inverse* species of electric action in the atmosphere has for site its middle region, or that of the clouds.—And it being, as assumed, by the loss or overthrow of the equilibrium of the direct species of this action incident to the collisions in the middle region of the air, between the masses of its opposite electrical aeriform bases, situated vertically in the scale of its ascent on either side, caused by the changes of electrical action, whether in the annual, the lunar, or diurnal circles, in which this the inverse species of electric action and formation of rain has its source.—And that, when the equilibrium of the direct species of electric action, in the inferior region, has acquired a certain degree of consistency or force, as during the opposite solstial seasons,

that it is only the electrical collisions in the middle region of the atmosphere induced by the lunar changes, or changes of electric action in the lunar circle, which at either solstice is of *an opposite name* to the existing dominant action in the annual circle, that has the effect of overthrowing the equilibrium of the direct species in any region where it has attained to such a degree of force, and of originating the formation of rain in the middle region.—Thence, I say, it is, that, during the periods of the domination of either primary electrical force in the annual circle—solar or planetary—in summer and winter,—the *accords*, or periods of corresponding electrical action in the lunar and diurnal circles with that of the existing dominant action in the annual, are those of the occurrence of the direct species of electric action in the atmosphere, and of fair weather. And that the *contrasts* in the lunar circle, or those periods of the latter when the lunar action is of a *different name*, and consequently of an opposite nature to the existing dominant action in the annual circle, are those during which the inverse species of electric action and rain usually occurs. And thence the *rule*, as assumed by our theory, in reference to the occurrence of fair weather and rain, viz. that the periods of the accords in the action of the primary electrical forces in the local circles of their movement,—annual, lunar, and diurnal,—out the year, are those of fair weather;—

and that, as stated,—the periods of contrast which occur between the annual and lunar circles, are those of the occurrence of rain and its accessory phenomena in the latter. The same species of relative dependence in reference to the weather, as that described between the annual and lunar circles, being assumed equally to subsist between the latter and diurnal circle, i. e. that it is the action of the *same-name* in the diurnal circle as that of the existing dominant action in the lunar, which, *in the order of its occurrence,* induces fair weather in the former; and that it is the action in the diurnal circle which is of a *different name* to the dominant action in the lunar,—notwithstanding that the latter be of a different name to the existing dominant action in the annual circle,—which, *according to the order of its occurrence*, induces rain in the former.

Thus, were the action of the opposite primary electrical forces in the *annual circle* always invariably the same,—or that the following influential causes did not almost continually—to a greater or less extent—interfere with, sò as to prevent an *equal* development of the lunar action on the weather,—nothing were more simple than to determine in advance the nature of the approaching seasons and changes of the weather. But as the action of the primary forces in the annual circle is, as assumed, influenced by the agency of the external planets of our system; and that, owing to the

changes continually taking place in the position of these bodies in the ecliptic in reference to the sun and earth, the action of these forces in the annual circle during any two years consecutively is never in all respects the same, as proved by the changes which continually occur between the seasons of different years:—thus it is, that, till the various bearings and amount of the influence of the external planets shall have been fully ascertained and determined by observation, it interferes to a certain extent, with ascertaining in advance the nature of the approaching seasons. And, as the *ground of its projection,* which determines at once the nature and extent of the lunar action on the weather, is, as already stated, the action of the primary forces in the annual circle;—and that, circumstances of locality the same,—owing to the continual state of progression or retrogression in the action of these forces in the latter, this its ground of projection during any two lunar tides of the same name consecutively, is never exactly the same:—combined with the, not unfrequently, very powerful influence on the weather exercised by local causes during summer and winter; as by the change of position in the main focus of the negative action of the earth at the equinoxes, and the violent atmospheric phenomena thence induced,—the influence on the weather exercised by which during these periods of the year is frequently much more powerful than

that of the moon:—thus, it is, and owing to the, not unfrequently, contradictory effects induced by the operation of these causes, that, even with a full knowledge of the nature of the lunar action on the weather,—difficulties of no small amount will, at times, be found connected with ascertaining, in advance, the nature of its approaching changes in reference to the lunar action. And yet, notwithstanding the number of exceptions to the preceding *rule*, in reference to the occurrence of rain and of fair weather in the lunar circle, incident to the operation of the causes enumerated, *proofs*, amply sufficient, as assumed, will, during every season, and in every variety of climate and locality, present themselves to the attentive observer of the weather, to satisfy him as to the correctness of our principles, in reference to the nature and source of temperature and other atmospheric phenomena, and of the important part exercised by the lunar action in their development.

Thus, then, assuming our principles to be correct, —the first, it will be observed, in the list of causes which influences the temperature and other phenomena of our seasons, and consequently, the effects of the lunar action throughout the latter, as contrasted one year with another, being, as stated, *that* exercised by the action of the superior and inferior planets; it is that, necessarily, which first claims our attention. And, ere entering into the detail of such facts, as I have thought it necessary to adduce

in proof of the existence and extent of this planetary influence, it may be right,—together with the dependance assumed to subsist between the principle of temperature and the other phenomena of the atmosphere at every period of the year,—to point out the nature of the connexion or *enchainement* which, from its commencement at the period of the winter solstice, throughout the remainder of the annual circle to its close, subsists between this the temperature at the commencement of the year, and the nature of the ensuing seasons, and periods of occurrence of their most remarkable atmospheric phenomena. In order to prove the existence of this enchainement, it will be sufficient to observe, that it is according to the force of the dominant action (the négative of the earth,) in the annual circle, at and subsequent to the winter solstice;—other circumstances being the same—that, first, the equinoctial phenomena of the ensuing seasons, in spring and autumn, develop themselves earlier or later;—and, secondly, that it is in proportion to the earlier or later occurrence of the equinoctial phenomena, that the temperature and weather of the succeeding seasons of summer and winter may be counted on. Thus, the *earlier* these the equinoctial phenomena occur in spring, the warmer, as the finer, it may be expected, will prove the ensuing summer; and *vice versâ*:—and the earlier they occur in autumn, the milder may be expected to be the ensuing winter, and *vice versâ.*—These, the

variations in the periods of occurrence of the equinoctial phenomena, as in the temperature of the seasons of different years, having, as assumed, their source in the changes, which, with those of their positions in the ecliptic, take place in the action of the superior and inferior planets on our atmosphere. From whence the following assumptions of our theory, viz. that the differences in the temperature, and other phenomena of the atmosphere during the *same seasons*, which occur in different parts of the same hemisphere, *are effects of location;*—and that the differences in the temperature and other phenomena of the atmosphere, which, during *the same seasons of different years*, occur within the same parallels, and in the same localities, are effects of the changes which take place in the relative position, and consequent influence exercised by the superior and inferior planets of our system. The *positive* electrical action of these bodies on our atmosphere, as assumed,—similar to the moon—being at the period of their conjunction and opposition, or while in the vicinity of, but more particularly *after passing* the colure of the solstices ;—having for effect to increase the mildness of our winters, and the heats of our summers. And the *negative* electrical action of those bodies at the periods of their *quadratures*, or while in the vicinity of, and after passing the colure of the equinoxes, having for effect to increase the cold of our winters, and lower the temperature of our summers. These variations of temperature, &c., in the

annual circle during different years, being esteemed the counterpart, or exact *fac-similes* of those which occur in the lunar circle, along the ascending and descending scales of temperature in the annual, during its opposite half-yearly electrical tides. Thus, the annual, as the lunar, exhibiting the spectacle of moveable eccentric circles, continually ascending or descending the graduated scale of temperature, or *ground of projection,* formed by the variable action, whether positive or negative, of the superior and inferior planets, to the action of the opposite primary electrical forces in either circle, in their collective agency on our seasons. The *base* of the annual circle, or that from, and according to which its subsequent seasons consecutively develop themselves, being the part of this ground of its projection, intersected by it at the period of the *winter solstice.* The lower the point of this its intersection at the latter period—as marked by the extreme degree of winter cold,—the lower being the point subsequently of *extreme elevation,* intersected by it (the annual circle) at the period of the summer solstice,—as marked by the comparatively low range of summer heat, and *vice versâ.* As the less the annual circle descends on this the ground of its projection at the point of its intersection at the winter solstice,—as marked by the mildness of the season,—the higher thence being the point of its intersection at the summer solstice,—as marked by the relative increase in the range of summer heat subsequently,—circum-

stances of latitude and locality being the same. Thus showing that nature, in her various phases, as relates to the same class of her operations, is still the same;—or simply, a combination of the same principles, however different the proportions. As affording recent and very marked illustrations of the principles here assumed, in reference to the annual circle and temperature of the seasons, may be cited the years 1828, 1829, 1830, 1831, 1832, 1833, and 1834. During the former of these years the *superior planets*, as is known, were approaching to a period of their conjoint *opposition*, which they attained in 1830, as was announced in the almanacs of that year. Now, the temperature of the seasons of 1828 and 1829, as will be recollected,—but more particularly of the latter year—was so very low, as to have attracted universal attention to the subject;—*fires* in the apartments during the summer of 1829, even at Paris, where I happened to be, being by no means unusual or unnecessary. And the severity of the following winter of 1829-30, fully corresponded with what, according to our theory, might have been expected to succeed such an unnatural state of summer temperature:—the thermometer in London, on the morning of the 18th January, 1830,—(being that immediately after the period of the *second quadrature* of the moon,) having marked 27° below the freezing point;—a degree of cold very unusual in England. And at Stuttgard, on the Upper Rhine, and in other parts of Germany lying

remote from the sea, the temperature this winter fell to 50°, and 57° below the freezing point. Immediately subsequent to this extraordinary fall of temperature, in the spring of 1830, I published, in London, my astronomical work, the "Rudiments of the Primary Forces of Gravity, &c.,"—and as illustrative of the principles assumed in this work, in reference to the nature of planetary temperature,—I was induced, from the circumstance stated, of the superior planets being advancing to the period of their opposition,—to hazard a conjecture in the "*Introductory Observations*," p. 84, to the following effect, viz. that we might anticipate *a very different range of summer heat* in 1830, as contrasted with the year before;—and thence that an immediate test would be afforded, whereby to form an estimate as to the degree of credit to which our assumed theory of planetary temperature was entitled. The summer of 1830, as I had anticipated, was certainly *warmer* than that of the preceding year; but as it was not so to the extent I had expected, the instance did not prove a conclusive one, inasmuch as the anticipation was not altogether justified by the event. And I mention the circumstance, in order to show the risk incurred—even assuming the principles to be unquestionable,—when, as in this instance, an attempt is made to anticipate results beyond what has been fully justified by previous observation and experience. For, ever in this case—as proved by the progressive

increase of temperature in the seasons, during the subsequent years of 1831, 1832, 1833, and 1834,*—had not its source in any thing defective in the principle on which the assumption was founded;—but in not having taken into account the immensity of the distance which separates us from the orbits traversed by the remoter of the planets,—the minute fractional proportion thence, as to extent—which our annual circle bears to those orbits; and of consequence, the *length of time* it would require from the periods of those bodies being in *opposition,* before the full force or *concentration of their positive action*—owing to the *oblique manner* in which similar to that of the moon, it arrives,—could develop itself on our seasons. And, in order to give an idea of the latter, i. e. the *obliquity* with which the action of the superior planets, whether *positive* or *negative,* develops itself on the temperature of our seasons,—as being a matter of so much importance to be understood,—we may cite the recent instance of the *negative* action of these bodies, which must have set in previous to to the periods of their *quadratures*—assuming it to have been the cause—

* That the high temperature of the summer of 1834, here alluded to, was not peculiar to this side of the Atlantic, the following extract from the London *Morning Post,* of the 23d August, 1834, will sufficiently show, viz.—" The Quebec and Montreal papers of the 16th and 19th instant," (meant of course for July,) " speak of the excessive heat of the weather, the mercury having risen to 95°, which had occasioned several deaths," &c.

not having fully developed itself, in our seasons, till the year 1829, or that which immediately preceded the year of their being in *opposition*,—which affords, it will be admitted, a proof sufficientlyconclusive.— Such development of their negative action, it will be observed, not having attained its maximum of force till the eve of the period when these bodies had traversed, from the periods when they were in their quadratures, *nearly a quarter of the circles* described by them in their orbits. This part of our subject, from its connexion with ascertaining in advance the nature of the approaching seasons, requires, it will be seen, nothing in the way of commentary to point out its importance.—Such being the fulness and perfection of the dispositions as connected with the fundamental principles of *union* and *mutual dependance*, on which the most extended, equally as the most contracted operations of nature in the creation were founded:—as proved by the vital principle of their temperature, as the other phenomena of their seasons, being the result, not of an individual, but *collective action*, originally established, and subsisting between the various members—primary and secondary—of the *planetary chain* dependant on, and encircling the sun: but which, as would seem, it was reserved for our age and country to be the first to discover, and to cts, of a nature so unquestionable as

PROGNOSTICS *in reference to the approaching seasons and weather.*—ANATOMY OF THE ANNUAL CIRCLE, *&c.*

As the results of much observation, and at the same time intimately connected with our subject, I have thought it right to give the following *indications* of the approaching seasons, collected from Dr. Kirwan's writings, as I find them copied into the Paris edition, 1830, of the "*Encyclopédie portative*," 39ᵉ liv. p. 271 and 272; together with the introductory and other observations of the author, viz. "*Signes indicateurs et Pronostics des Météores.*—Les instrumens météorologiques font apprécier plus exactement les phénoménes, mais on ne peut pas toujours les consulter, et, d'ailleurs, ils mesurent plutôt *l'etat actuel du temps qu'ils ne font prévoir cet état à l'avance;* il faut donc tirer le meilleur parti possible des *signes empiriques,* et connaître les *pronostics* vulgaires du temps, lorsqu' ils ne sont pas évidemment absurdes, ou ne reposent pas sur la superstition ou d'anciens préjugés profondément enracinés. Ces indices du temps peuvent être tirés de signes généraux fournis par les météores euxmêmes ou par l'atmosphère, ou de signes particuliers donnés par des instrumens et des appareils destinés à cet usage, ou fournis par le règne minéral, le règne végétal, ou le règne animal; il faut y ajouter les predictions populaires

dont l'origine n'est pas immédiatement aperçue, mais qui néanmoins ne doivent pas toujours être entièrement méprisées."

Règles du Temps d'apres les Calculs des Probabilités.—"Le Dr. Kirwan a tenté récemment d'établir des règles de probabilité pour prédire le *Temps* en différentes saisons. En comparant les tables d'observations dressées en Angleterre de 1677 à 1789, il a trouvé, 1° que quand *il n'y a pas eu d'orage avant ni aprés l'équinoxe de printemps, l'été suivant est généralement sec,* au moins cinq fois sur six. 2° Que quand un orage arrive de l'est le 19, le 20, ou le 21 Mai, l'été suivante est sec quatre fois sur cinq. 3° Que quand un orage a lieu le 26, le 27, ou le 29 de Mai (et non auparavant,) l'été suivant est également sec quatre fois sur cinq. 4° Que quand un orage arrive de l'ouest du 19 ou 22 Mars, l'été est généralement humide cinq fois sur six." "Nous citons ces exemples sans y ajouter une grande foi; car, d'une part, ils doivent varier en raison du pays, et d'une autre part, *nous ne voyons aucune liason entre le phénomène produit et la prédiction;*" &c.—Again, in another part of this volume, p. 48 and 49, are the following observations on this subject:—"Quelque irréguliers et capricieus que soient tous les changemens qui ont lieu dans l'état de l'atmosphère, on ne peut nier qu'ils ne soient les résultats necessaires de principes fixes, peut-étre aussi simples que ceux qui préside aux mouvemens des astres. Si nous pouvions

en demêler le labyrinthe inextricable, nous connaîtrions l'action de chaque cause, et nous pourrions en déduire les effets éloignes qui doivent prévenir de leurs opérations combinées; pourvus de ces données, nous serions à même de prédire sûrement l'état du temps pour une époque future, comme nous calculons une éclipse de lune ou de soleil, ou la conjonction des planèts. Quand la chaîne entière des combinations est épuisée, la même série d'événemens doit tonjours se représenter dans le laps illimité des temps." "Mais tout ce qu'on doit dire en ce moment, c'est que les nombreuses règles et les remarques qui nous out été laissées dans le cours des âges, par des hommes de tout état, souvent intéressés hautement par leurs occupations à connaître les changemens du temps, peuvent contenir *quelques vérites importantes que la sagacité des physiciens pourrant distinguer et employer pour fonder une heureuse théorie.*" And thus, as expressed higher, in treating of this subject, that, "nous pouvons espérer de découvrir *un rayon de lumière et de lire les changemens qui sont recélés dans le sein du temps.*" Such, it may be observed, are the leading facts and observations connected with the weather, which are to be met with in the pages of this work, embracing, as we may suppose, from the industry of its author, M. C. B. de Merlieux, all that could be advanced on the subject at the period of its publication in 1830. And which goes fully to admit the absence of any

fixed principles, in reference to ascertaining the nature of the approaching seasons and changes of the weather; and, consequently, that, as far as relates to these subjects, meteorology could not, as yet, be considered to rank in the list of the sciences. And thus, though giving insertion to the *prognostics* collected from the tables of Dr. Kirwan, the author honestly admits his inability to discover any connexion betwen them and the nature of the approaching seasons,—"*nous ne voyons aucune liaison entre le phénomène produit et la prédiction,*" &c. And, notwithstanding the number and importance of the interests depending on this question,—so far, but no farther,—*unaided by principles,* was it possible for human industry to push our knowledge of atmospheric phenomena; which may serve to place in its true light the importance of the discovery which has led to the present theory, viz. the analogy between the lunar action on the tides and temperature;—furnishing, as it does, that "*rayon de lumière,*" so long previously, yet so fruitlessly sought for, as being indispensable, in order to making any further advances in this department of science.

Thus far, as showing the indispensable necessity which existed, in the first place, of making this discovery, in order to raise meteorology to the rank of a science. But perhaps a no less important circumstance connected with this discovery, in order to make it as fully as possible available, is the manner

of applying the principles connected with it, and to the discovery of which it has led, to their most important objects, viz. those of ascertaining in advance the nature of the approaching seasons, and changes of the weather. And as, without the aid of those *fixed and invariable rules* in geological inquiry, to which "the interesting and beautiful department of science called *Comparative Anatomy*," has led, and with which the name of the illustrious Cuvier is so intimately connected,—owing to the nature of the subject,—the rapid and important advances latterly made in this science, never could have been effected:—and that, not only a close conformity is found to exist between the different sciences, but that it is only by the application of similar principles in reference to certain of them, that approaches to perfection can, as in the instance cited, with any prospect of success, be attempted:—and, as with the department of geology connected with the science of fossil remains alluded to, thus it is with the department of meteorology connected with the variations of the seasons and weather. For as, similar to the greater part of fossil remains when found,—instead of being united together in their primitive and natural order, and thus of presenting *a perfect whole*, that it is only in detached parts or fragments they present themselves; thus it is with this department of meteorology; as, instead of the whole of the variations of the temperature and

weather of the *annual circle* or year, presenting themselves collectively and at once to the observer,—that, except retrospectively, it is only in consecutive succession, or by the gradual development of the *parts* they come under our observation. And further, that, similar to the "human face divine," though between the entire of the annual circles, the general ensemble of the features is the same, that no two of these circles present themselves in which,—however proximate the resemblance be,—they are, in all respects, alike. But as, notwithstanding these discrepancies, there are in each of the annual circles certain *prominent parts*, which, according to their character and the positions they occupy, are found to bear a strict relation, or determinate proportion to others by which they are succeeded;—thence it is, as in geology, that by an application of the principles growing out of the *comparative anatomy* of the parts which compose the annual circle, once this their mutual dependence and relationship is duly ascertained,—that every thing like doubt in reference to the nature of the approaching seasons and changes of the weather may be expected, as in the case of the tides, of eclipses, &c., in all material points, to be succeeded by certainty. And, as the most sure, if not the sole means, in prosecuting this very intricate, yet most important department of science, by which even relative perfection can be attained, it is that which I propose to others, and,

as stated in the " Introductory Observations," have adopted myself.

And, as regards this the comparative anatomy of the annual circle, its chief or cardinal points, as its seasons, are *four* in number, viz. the *equinoxes*, and the *solstices*:—and, of the phenomena connected with the latter, as relates to our subject, the most important are those of the equinoxes in spring and autumn. For, owing to the equinoctial phenomena being, as assumed, both *retrospective* and *prospective*, in reference to the opposite solstial seasons by which they are preceded and followed;—and from the influence, whether on the temperature or on the violent class of atmospheric phenomena during the latter seasons, exercised by *localities*, having no connexion with these the equinoctial phenomena; but that, as regards the relative positions they occupy in the annual circle, they are altogether determined in the periods of their development, whether by the temperature of the past, or of the approaching solstial season;—thence it is, considered as *landmarks* in the meteorological year, that the equinoctial phenomena are esteemed to hold the first place;—as will be made more fully apparent in the subsequent pages.

Of the solstial points it will be sufficient to observe in this place, that the most important is that of the *winter solstice*. The state of the temperature at or subsequent to the latter period exercising a

more lengthened and marked influence on the seasons and weather by which it is succeeded, than that at the opposite season of the year, or in summer, other circumstances the same.

The next or minor points in the annual circle which claim our attention, as regards this its comparative anatomy, are the lunar *syzygies*, and lunar *quadratures;* and of which, in point of importance, the former periods take precedence of the latter. And finally, as relates to the lunar *syzygies*, there is this remarkable difference, viz. that during the opposite solstial seasons of winter and summer, the moon at the period of the change or *new moon*, appears to exercise the most powerful influence on the temperature and weather; whereas, in reference to the equinoctial seasons,—the period of *new moon*, in spring, and of *full moon* in autumn, appears—at least in our skies—to exercise the most powerful influence in reference to the equinoctial gales, or violent class of atmospheric phenomena. These however, together with other circumstances connected with the lunar action, will be found more fully noticed in treating of the *lunar circle*. But, to resume the subject of *prognostics*, and the assumed connexion, as deduced from the tables of Dr. Kirwan, between the occurrence or non-occurrence of storm at or about the period of the vernal equinox, and the relative humidity or drought of the following summer. This, as would seem, con-

stitutes the extreme limit between empiricism and science, as relates to the question of an *enchainement* or connexion subsisting between the violent class of atmospheric phenomena at the equinoxes, and the temperature and weather of the succeeding solstial seasons;—as, without the assistance of other aids, *observation* could not enable us to advance an inch further in tracing any such connexion. That such connexion, however, exists, and is of the most intimate kind, I hope to make appear, so as to remove all doubt respecting it. Thus, admit for instance, the presence and alternate action on the atmosphere of *opposite forces* of the same kind, agreeably to our theory,—both as regards the diurnal, the lunar, and the annual circle; and not only the connexion assumed, but the intimate dependence in the annual and lunar, equally as in the diurnal circle, between the principle of its temperature and the periods of the occurrence subsequently of its other most remarkable phenomena in these circles will become apparent. Remove, however, these fundamental principles, and what follows?—Why, that not only all such connexion will disappear, but that nature, as refers to the vital principle of atmospheric temperature, and the consecutive development of its other phenomena ingrafted thereon, will be found *in direct contradiction with herself.* As, in attending to the operations of Nature in the other departments of the material world, we shall find

that the whole of her dispositions are founded on *system*, or the operation of determinate and invariable principles, in which *unity of action* and of *purpose* are conspicuous, as being directed to the accomplishment of fixed and definite results. But, in order to remove all suspicion of any such incongruity in the dispositions of Nature, as relates to the atmosphere, in reference to the seasons and weather as connected with the annual circle, let us proceed to details.—From the winter solstice to the period of the vernal equinox is three months, or a quarter of the annual circle; and thence to the periods of *storm* in May, indicated by Dr. Kirwan, is nearly the same length of time. Thus, the first thing that strikes one on a review of these circumstances—considering that they come recommended to us as being the results of many years observation—is, that from the period of the winter, to that of the summer solstice, certain *crises* of electric action occur in our skies at intervals of about *three months apart*, which develop themselves *in storm*. And which, similar to mountain heights, from their towering above the comparative level traversed by the intervening phenomena, serve, from *the positions they occupy*, as *landmarks* in reference to the nature of the phenomena by which they are succeeded. And that on the occurrence, or the non-occurrence of the first of these crises at, or about the period of the vernal equinox, is, in general, found to depend

the relative drought or humidity of the succeeding summer. A very unfortunate omission, however, occurs in Dr. Kirwan's observations, as, notwithstanding the word *avant,* equally as the word *après,* the vernal equinox, in reference to storm, occurs in the cited observation of the latter; he cannot be supposed to mean that this the vernal equinox can, under any circumstances, pass, without inducing its accustomed effects. And thus that this observation only refers to the phenomena which occur at, or about the period of the equinox, but not to the storms which may occur some time previous thereto. This defect, however, I shall attempt to remedy; and, by a reference to the preceding article which treats of the connexion assumed to subsist between the *lowest degree* of winter temperature, and the period of the occurrence of the vernal equinoctial phenomena subsequently. And further, between this the lowest degree of winter cold, and the highest degree of summer heat at the opposite period of the year,—the whole of the circumstances connected with the consecutive enchainement assumed to exist between the temperature and other atmospheric phenomena of the seasons, particularly when sustained by facts, will be found not only easy of explanation, but irrefutable.

And, as being exactly in point, by affording a striking illustration in proof of the correctness of our principles, may be cited the temperature and

phenomena of the year 1833. The winter of 1832-33, as will be recollected, was unusually mild; and the period of the occurrence of its *first* electrical crisis,—connected at once with the transit of temperature in its annual ascent, and with the equinox,—was on the 20th of February.—Sufficiently memorable, it may be observed, from the destruction of shipping it occasioned on our coasts. The *second* electrical crisis of 1833,—and which, when, as in the present instance, it is the precursor of a dry summer, takes place, as noticed in Dr. Kirwan's tables, sometimes the 19th, the 20th, or 21st; and sometimes on the 26th, the 27th, or the 29th of May,—happened on the 22d of May, and subsequent days, viz. the terrific *hail storm* which, as stated in the papers, occurred in the channel near Liverpool on this day; and, among others, the disastrous thunder storm in Scotland on the 24th, by which some lives were lost, two days after the first. These phenomena having been preceded, during some days, by excessive heat; and marked the setting in of the *periodical rains* at this period of the year in our skies, by which they were succeeded till about the middle of July. Thus, as will be observed, this second electrical crisis having succeeded the former after an interval of *three* months;—being, as noticed, the precursor of the dry summer which followed.

The *third* electrical crisis of 1833,—and though

so long preceding, being connected, as assumed, with the autumnal equinox,—took place on the night of the 30th, and morning of the 31st of August, in the violent hurricane which occurred in the channel and along the French coast, &c. at this period, accompanied, as usual, with shipwrecks, and loss of life. Thus succeeding to the previous drought in summer; and being, after an interval of *three* months and six days from the period of the second electrical crises, as noticed.—And finally, the *fourth* and last of these storm crises of 1833, as by much the most destructive in its effects, took place on the night of the 28th and morning of the 29th of November, in the furious gale which at this period extended along the coasts of the United Kingdom, and of Europe, carrying dismay and destruction in its course:—being exactly *three* lunar months from the period at which the *third* of these electrical crises occurred in the latter end of August.

Thus, assuming the first of these storm crises in February to have been connected with, so, as to have been mainly determined in the period of its early occurrence by the mildness of the preceding winter, it will be perceived, at a glance, that not only the periods of occurrence of the remainder of these crises, but that the increased drought and heat of the succeeding summer of 1833, were amongst the most prominent in the list of the meteoric enchainements connected with the winter temperature of

1832-33. Thus developing themselves, consecutively, and with a degree of truth, as connected with the principle of temperature in summer—and of exactitude in point of time, or the quarterly intervals by which these storm crises were separated one from the other,—which may astonish those who, for the first time, have had their attention directed to this view of the connection which pervades the entire annual round of atmospheric phenomena.

These, then, may be considered as constituting the primary elements or *ground plan* of the *Meteorological Chart,* and *cardinal points*, by which calculations, in reference to the nature of the approaching seasons and weather may, according to our theory, be founded; and a sketch of which will be found at the conclusion of this article. And were the assumed relation between the *lowest degree* of the preceding winter temperature, and the period of occurrence of the first of the storm crises, connected with the vernal equinox by which it is succeeded, fixed and invariable; as in the consecutive development, subsequently, in regard to the temperature of summer, and the periods of occurrence of the remainder of these storm crises in the order pointed out; nothing, it will be seen, would be more simple than at the commencement of the year to determine in advance the nature of the approaching seasons, and the periods when the greatest danger from storm might be apprehended.—Unfortunately, however,

there is but too much reason to suppose that, notwithstanding there are, as I feel warranted in assuming, fixed and determinate relations between the range of temperature in winter and summer; yet *exceptions* will be found to occur in reference to the assumed connexion between the lowest degree of winter cold, and the earlier or later occurrence of the equinoctial storm crises subsequently in spring: —if not between the latter period, and those of the storm crises by which it is succeeded, which it were risking too much to pronounce confidently on, before further observation shall have examined, and fully ascertained every thing of importance connected with these reciprocal relations. And that such a want of uniformity and relative dependence between the state of the temperature in winter, and the period of occurrence of the chief storm crises of the vernal equinox, subsequently, occasionally occurs, a recent instance will sufficiently testify. This instance happened in the spring of 1834. The winter of 1833-34, notwithstanding its frequent storms and rains, was, as is known, if possible, even milder than the winter of 1832-33. After which latter, as stated, the chief storm crises connected with the vernal equinox of 1833, occurred so early as the 20th of February, or 51st day of the year; whereas, notwithstanding the mildness of the preceding winter, and that, as on the year before, a gale occurred on the afternoon of the 20th of February, 1834, which,

at the time, I considered as being connected with the approaching equinox;—the real storm crisis of the latter, did not set in till Sunday, the 23rd of March, or 82nd day of the year: and the period of its greatest development did not occur till the fifth day after, the 28th, or 87th day of the year; when the gale throughout the day, accompanied, occasionally, with rain, was very violent from south-west. Thus, it will be observed, this, the storm crisis connected with the vernal equinox, occurred thirty-one days later in 1834 than in the preceding year; and this without any corresponding fall of temperature during the preceding winter, having occurred to induce such a difference. Another peculiarity connected with this storm crisis in1834, which distinguished it from any thing of the kind at this period of the year that I had observed before, was, that it was preceded by the setting-in of the *north-east* wind on the 12th of March, being the second day after the period of new moon, and which, accompanied with *frost*, particularly at its close on the night of the 20th, continued, without intermission, during eight days. This having been the first time I had known the north-east wind in spring to set in till *after* the equinoctial gales.

Now, assuming the existence of a fixed and determinate connexion and dependence between the winter temperature, and that of the following summer, as stated,—notwithstanding the influence of the lunar action, on these the equinoctial phenomena,

which, as shall be noticed under the proper head, is always very marked; yet it is not such as can in any way account for a difference so considerable in the periods of occurrence of the chief storm crises connected with the vernal equinox in these years, as that noticed. And as in nature there is no effect without its cause; and that, the lunar action apart, the only other *adequate* cause which could interfere to induce such a difference, must be sought for in the changes of position, and consequent agency of the superior and *inferior* planets;—and as, from the difference of magnitude in their masses, as in the length of their orbits, that the superior planets—particularly of such as lie the most remote from us,—are those which are esteemed to exercise the greatest influence, consecutively, on the temperature of our seasons;—and, on the other hand, from the masses of the inferior planets being relatively so diminutive, and their orbits so circumscribed, as contrasted with the superior planets, particularly *Mercury*, whose periodic time is no more than eighty-seven days, or about three times that of the moon,—that their action can have but little influence on the consecutive temperature of our seasons, but the changes in which, notwithstanding, may be amply sufficient to induce differences in the periods of occurrence of the equinoctial phenomena, of the nature of those stated.—To the latter, as being the most probable cause, i. e. the variations in the posi-

tive and negative action of the *inferior* planets, it is, to which I think should be ascribed, as to its source, these changes in the periods of occurrence of the equinoctial phenomena,—other circumstances being the same. And as the periods of the *quadratures* and *syzygies* of these bodies can be ascertained with the same degree of precision as those of the moon; thus, by the aid of some observation directed to this part of our subject, every thing connected with its bearings, whether as relates to the equinoctial, or other atmospheric phenomena throughout the year, may be ascertained with such a degree of accuracy, as that it may be added to the other elements of calculation in reference to the meteoric phenomena of the approaching seasons. Of these the inferior planets, it may be further observed, that both from its greater proximity, and superior magnitude,—the action of *Venus* on the temperature and other phenomena of our seasons, must be much more considerable than that of *Mercury*. But as neither, though probably highly influential in certain respects, can be supposed to approach that exercised by the superior planets; thence, I think, we may conclude, that the *rule* in reference to this planetary agency, as relates to the assumed connexion between the relative degrees of temperature in winter and summer, as between the temperature at the former period, and that of the occurrence of the chief storm crises connected with

the vernal equinox, and the others subsequently, is to be ascribed, as being an effect of the conjoint influence exercised, consecutively, on our seasons and weather by the *superior planets.* And that the *exceptions* which occur to this rule—in either case—i. e. whether as regards the discrepancies between the extreme degrees of temperature in winter and summer, or between the temperature of winter, and the chief storm crises of the year,—are to be ascribed to, as being effects of the temporary influence of an *opposite kind,* which at times is exercised by the *inferior planets* on our seasons and weather; the relative proportion between the seasons of different years, in reference to this the *rule* and its *exceptions,* being,—as refers to the temperature and weather in winter, and following summer,—according to Dr. Kirwan, in the proportion of *five times out of six.**—

* That the principle here assumed in reference to the state of the temperature *in winter,* is—(notwithstanding the *exceptions* to this, as to every thing else connected with the phenomena of the atmosphere, which will occasionally be found to occur,)—*the rule,* in reference to the temperature at the opposite season of the year, or approaching summer, will become manifest, by turning our attention to these circumstances as connected with the lower, the middle, and higher latitudes of the same hemisphere, during the opposite seasons of *the same year.* For here we shall find the principle advanced completely borne out by the fact; as where for instance, in the lower latitudes, the cold in winter *is least,* the heat in summer *is greatest;*—and where, in the middle or higher latitudes the cold in winter *is greatest,*—the range of summer heat is likewise the *lowest,*—other circumstances the same.

I may further observe while on this subject, that the *second* storm crisis in the latter end of May, which, as observed by Dr. Kirwan, prognosticates a dry summer, is assumed to be an effect of the increased *concentration* of the negative electric action in our skies, consequent on the rapid increase of heat then progressing on either side, in the higher equally as in the lower latitudes, approaching the period when a relative equilibrium of temperature becomes established throughout the atmosphere of the entire hemisphere. Which rapid increase of temperature at this period, by inducing, as stated, such concentration of the opposite or negative action in our skies,—as being the most *central*—combined with our proximity to the sea, has the effect of thus causing the latter action to explode and develop itself in tempest. We can, on the contrary, on these principles, easily conceive, that a less powerful action of the sun in the early part of the summer, as it will induce a less powerful and rapid concentration of the negative action in our skies, will not be so remarkable for inducing these tempests in May, as when the solar action is more powerful; and thence that the absence of these tempests at this period of the year is

—But which order or succession of temperature in the annual circle, it may be added, either the incipient *change of action* in the superior planets, from the period of the winter, to that of the summer solstice, or the approach of one of the superior class of comets during this interval, equally as the opposing action of the lozenge.

considered, and with reason, as being indicative of humid and cold summers. It is further to be observed, that in the event of *two* mild winters succeeding each other,—as was the case in 1831-32, and 1832-33,—and that the former has been preceded by a *severe* winter;—that the vernal equinoctial storm crisis which succeeds the first—other circumstances being the same—falls *later*, as was the case in the spring of 1832, than after the second, —which, as noticed, occurred on the 19th and 20th of February:—the relative difference in the contingent effects, arising out of those of the relative quantity or amount of the negative action of the earth on the atmosphere at these different periods, being exactly expressed by the difference in the periods at which the subsequent storm crises they induced occurred; equally as in the difference of drought and heat which distinguished the succeeding summers.

In reference to the *third* storm crisis connected with the autumnal equinox, I am free to admit, that till facts proved the contrary, I had long supposed that, similar to the *first* of these crises in spring, being, under such circumstances, indicative of a dry and warm summer,—its *early occurrence*, or before the period of the equinox, was indicative of its being succeeded by a *severe winter;* or, in other words, that the period of its occurrence was determined more by the nature of the *progressing* negative tide,

of the annual circle, than by that by which it was preceded. However, its occurrence not only in the autumn of 1833, on the 30th and 31st of August, as stated;—but likewise in the autumn of 1827, when it was marked by a *great fall of snow* on the nights of the 26th, 27th, and 28th of August, on the high mountains of Corsica; as in 1833, by a similar fall of snow on the Pyrenees; and its being in both cases succeeded by *mild winters*;—these circumstances, I say, have satisfied me that the period of occurrence of the third storm crisis is contingent on the periods at which those by which it was preceded occurred. And thus, that it follows in the list of meteoric enchainement connected with the state of the temperature at the commencement of the annual circle. And that, instead of its early occurrence being indicative of the approach of a *severe*, it should, on the contrary, be considered as indicative of a *mild*, though stormy winter.

It may be further observed, that the *concentration* of the negative action of the earth during the summer *transition* quarter, which is one of the concurring causes in inducing this the third electrical crisis, sets in earlier in the higher than in the lower latitudes; and, consequently, should produce its effects sooner in the former than in the latter. Thus we are enabled to account for the heavy *fall of snow* which occurred at Sarendal in Norway, on the 11th of July, 1827, by means of which, as stated in the

papers at the time, two men and several head of cattle perished of cold.

Of the *fourth* and last of these storm crises, in November or December, it will be sufficient to say, that, judging from the greater degree of exactitude in regard to *time*, in reference to the order of its occurrence in the annual circle, after an interval of *three* months from the period of the *third* of these crises, as in 1833, than in the third, in reference to that by which it was preceded in May;—that the period of occurrence of this the *fourth*, is more strictly contingent on the storm crises by which it is preceded, than what the latter is on the *second*. And as the same exactitude is observable in the period of occurrence of the *second* storm crisis, in reference to the *first*, or that by which it was preceded;—thus, that, notwithstanding the general enchainement subsisting between these phenomena from the commencement to the conclusion of the annual circle,—that, from either solstice to the opposite, this enchainement is more intimate between them, than is the case between those which occur at the *opposite sides* of the solstice.

It is further to be observed, that, as electric action in the atmosphere is of opposite species—*direct* and *inverse*;—and that a powerful development of either species during the solstial seasons in any region of the atmosphere, necessarily implies a feeble or partial development of the opposite in such

region at the time;—thence it is, as occurred in the winter of 1833-34, that, as will always be the case in mild winters, from the dominant action on the atmosphere inclining to, and developing itself much more powerfully in the inverse species of electric action, and in its accessory phenomena rain and *storm*, than in the direct species and frost; that in winters remarkable for rain and storm, the frosts induced by the direct species of electric action can never be considerable; and *vice versâ*. As, though the few storms which occur on severe winters may, —owing to the degrees of *contrast* under which they occur,—be very destructive; yet their number or frequency will be much less on such than on mild winters.

I may add, that the frequent appearance of the *aurora borealis* in autumn or later, is much more indicative of a moist and stormy, than of a dry and frosty winter. This shows that the *aurora borealis* in autumn or in spring, or at whatever period it occurs, has its source in the incipient or first stage of the inverse species of electric action in the atmosphere; but that being induced by the changes of electric action in the *annual circle*, it takes a range at such periods considerably *higher* than when, as under ordinary circumstances, it is originated by changes in the lunar or diurnal circles.* And

* This, it is hardly necessary to say, will at once account for the *storms* which usually succeed the appearance of the *aurora*

would seem to imply, at least in the middle latitudes, a relative weakness in the existing dominant action in the annual circle at the time; to which the mildness of the season subsequently is to be ascribed. The correctness of these assumptions, it may be observed, was amply borne out by the frequent appearance of the *aurora borealis* in the autumns of 1827 and 1833; and by their absence in the autumns of 1828 and 1829. The following winters in the former case, having been much more remarkable for rain and storm than for frost; as in the latter for frost, than for the occurrence of storm and rain.

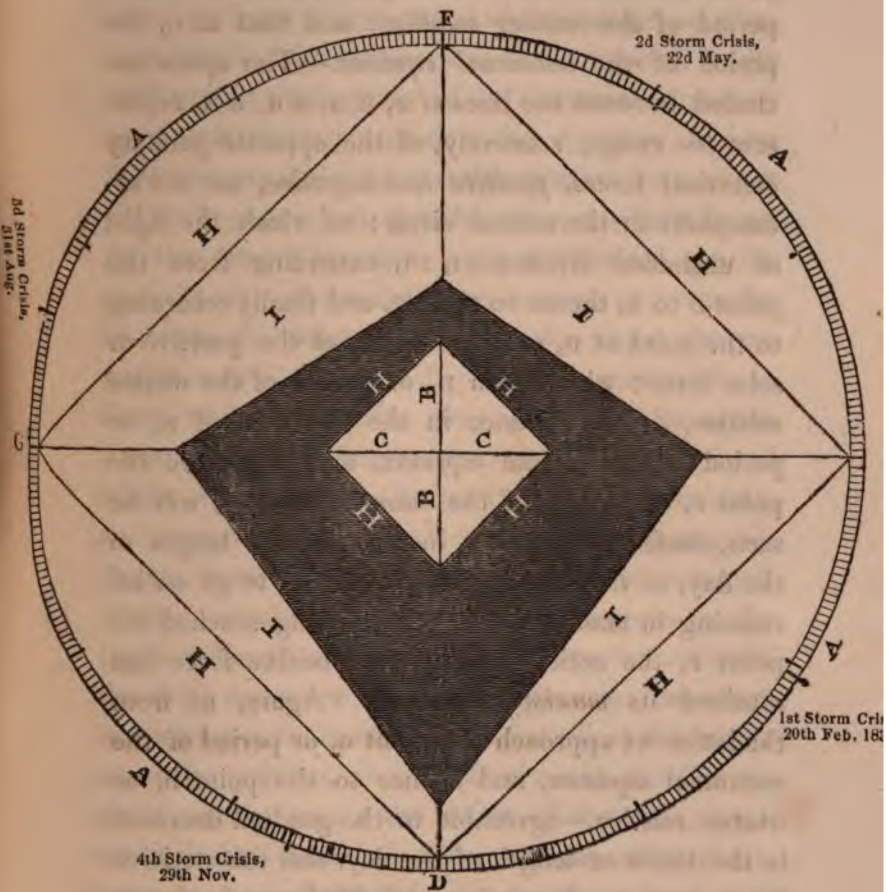
In concluding these observations on the subject of prognostics, it may be right to notice that in the number of the *Encyclopédie Portative* from which those already cited are taken, there are others in reference to the connexion observed to subsist between the state of the weather in autumn, and the nature of the approaching winter, &c. But that, as the substance of these prognostics is embraced and discussed in the preceding observations, I do not think it necessary to allude more particularly to them in this place.

And as I esteem a *meteoric chart* of the seasons,

borealis; being generally so slow in their development, but at the same time the most violent of the year; owing to the greater *depth* and *volume* of the atmosphere embraced within their range, than within that of the ordinary class of tempests induced by the lunar changes.

of the nature of that alluded to in a preceding paragraph, not only called for, but in some sort indispensable, in order rightly to apprehend the principles of our theory as refers to the temperature and other leading atmospheric phenomena of the annual circle. I am thus induced to subjoin the following sketch of such a chart, though in a form far less complete than what from its nature—if done justice to—the subject would require:—

METEORIC CHART OF THE ANNUAL CIRCLE OR YEAR



In this diagram, the circle A A A A, represents the annual circle of electric action, or year; B B the line of the *solstices* ; C C the line of the *equinoxes* ; the

point at D, the period of the *winter solstice;* that at E, the period of the *vernal equinox;* that at F, the period of the *summer solstice;* and that at G, the period of the *autumnal equinox.*—The space included between the lines H H, H H, H H, H H, represent *the range,* relatively, of the opposite primary electrical forces, *positive* and *negative*, on the atmosphere in the annual circle; of which the light or unshaded division I I, I I, extending from the point D to E, thence to F, to G, and finally returning to the point at D, represents that of the positive or solar force; which from D, or period of the winter solstice, as we advance in the direction of E, or period of the vernal equinox, and thence to the point F, or period of the summer solstice, will be seen, conformable to the increase in the length of the day, or *times* in the diurnal circle, to go on increasing in amount; till finally, having reached the point F, the action of this the positive force has attained its *maximum amount.* Again, as from the latter we approach the point G, or period of the autumnal equinox, and thence to the point D, or winter solstice,—agreeable to the gradual decrease in the times or length of the day, this the positive force goes on decreasing; till finally at the latter point, it has descended to its *minimum degree* or amount. On the other hand, the opposite or *shaded half* of this space represents the annual range or relative amount of the *negative,* or planetary pri-

mary electrical force. The amount of this force, conformable to the times in the diurnal circle, being at its *minimum* at F, or period of the summer solstice; from which, with the increase in the times or length of the night to the period of the autumnal equinox, it goes on increasing in amount,—its opposite, the solar force, in precisely the same proportion decreasing; till at the point G, the relative amount of both forces, as the times, becomes equally balanced on the atmosphere. From the point C to D, with the increase in the times or length of the night, the negative action of the earth progresses continually in force, while its opposite, the positive or solar action decreases; till having reached the latter, or period of the winter solstice, it has attained its *maximum*, as its opposite, the solar force, its *minimum degree.* Again, from the point D as we ascend to E, or period of the vernal equinox,—with the decrease in the times or length of the night, the negative action of the earth decreases in force,—its opposite, the solar, increasing in the same proportion; till at the latter, as at the point G, when their times in the diurnal circle are the same; the action of these the opposite primary electrical forces on the atmosphere becomes anew balanced one to the other: and finally, as from the point E we progress to F, the negative action continues gradually to decrease, with the increase of its opposite, till arrived at F it is again at its minimum, as its opposite, the solar,

at its maximum of force. Thus these opposite actions in the diurnal and annual circles present the spectacle of forces *continually in contrast;* as that which is lost to the one is incontinently added to the other. And from the simplicity of these principles,—were it not for the presence of another and homogeneous agency on the atmosphere, i. e. the lunar,—distinct from the action of the opposite primary electrical forces in the annual circle,—the task of showing the relative connexion of either force with its opposite throughout the year, were comparatively easy. And by a slight inspection of the relative disposition of the opposite primary electrical forces in the annual circle one to the other, as exhibited in the chart, it will be seen that the *base* of the dominant action of either force, is from the line G E, whether of the solar action in its ascent from E to F; or, reversing the chart, of the negative action of the earth in its ascent from G to D. And as this the base of the dominant action in the annual circle in its consecutive ascent, is that likewise in the latter, which constitutes the base or *ground of projection* to the lunar action on the atmosphere, and deprived of which the effects of the latter, for some time, become deranged, (as stated in a preceding article,) and are no longer to be counted on as before;—thence, I say, the necessity which existed of sub-dividing the opposite, or summer and winter divisions of the annual circle from t[illegible] of the equinoxes, as bisected by that

of the solstices, into opposite, or *progression* and *transition* quarters, agreeable to our theory. Again, suppose the lunar action on the atmosphere—whether positive or negative—to be as *one;* and, as refers to its mean amount, to be invariable throughout the year;—suppose, again, that the relative action of the opposite primary electrical forces on the atmosphere on the line of the equinoxes at G and E, to be at *Zero,* or equally balanced one to the other; while this their relative action at F and D, or on the line of the solstices, is as *four* to *one*:—the relative action of these forces at a point equidistant from E F, F G, G D, and D E, will be as *two* to *one* on the side of the existing dominant force; and so in reference to the other points on either scale, proportioned to the times in the diurnal circle, or distance from the line G E. This premised, it will appear evident, that the parts of the annual circle where the lunar action should manifest itself most powerfully on the temperature and other phenomena of the atmosphere are at, and in the vicinity of the points G E, on either side. And that the parts of this the annual circle where the lunar action should least palpably manifest itself on the temperature, &c. of the atmosphere, are at and in the vicinity of D F, or line of the solstices, other circumstances being the same.

Again, let the unshaded space I I, to the right, from F to D, be supposed to represent the graduated

scale of temperature, and of force in the solar action *at the same period of time,* along the ascending parallels of the same hemisphere from the tropic to the pole ;—the part of the scale at F representing the relative force of this action at the former, and its opposite at D, at the latter :—it will appear evident, that on the part of this scale where the solar action is weakest,—and, consequently, the approximation between it and that of the lunar action is greatest, i. e. in the middle and higher latitudes,—is that where the latter action will, most palpably, manifest itself on the weather. And that, on the opposite extreme of this scale, where the solar action is the most powerful, and the contrast between it and that of the moon is the greatest, or in the lower latitudes,—is that where the lunar action will the least palpably manifest itself on the weather,—other circumstances the same. And as by reversing this scale with its opposite—the *shaded,* or that which represents the negative action of the earth,—i. e. with its base at the pole, and its summit in the vicinity of the tropic,—and for the summer, substituting the winter half of the annual circle; the analogies along it, in reference to the lunar action on the weather during the winter progression and transition seasons,—under the various relations noticed, will, as assumed, be found perfect in all their detai[illegible] [illegible]e and correct ideas ma[illegible] which, throughout

the year, assist either in enlarging or restricting the apparent influence of the moon on the weather, along the various parallels of either hemisphere, than it were possible to convey without the assistance of our meteoric chart. And if *between the same parallels* that a variety were introduced in the relative force of the positive action of the sun on the temperature in summer, and of the negative action of the earth in winter, by reason of the difference locally in the nature of the reflecting surfaces beneath, corresponding to the inequality which, as noticed, subsists between the opposite extremes of the ascending scale of parallels;—it will, at once, appear, that where from the nature of the reflecting surfaces beneath, the solar action on the temperature in summer, as in mountains, where *least* powerful, that of the moon on the weather would be *most* powerful;—and that were from the nature of the reflecting surfaces at this season, as on planes, and in the interior of continents, the solar action on the temperature is *most* powerful,—that of the moon on the weather will be *the least* so:—and *vice versâ,* as relates to the opposite half of the year, or winter. Further,—the true or natural division of the meteoric year, is, according to the line of the *solstices*, and that of the *equinoxes;* but which, as it does not correspond with the division of the *calendar* year, as marked in the almanacs, a discrepancy between these divisions is, necessarily, the consequence:—

thence causing that the progression of the months, as refers to each division, must be dissimilar. However, by allowing for the time which elapses from the period of winter solstice to that of the first day of the calendar year, or *New Year's Day*, it will not be difficult to reconcile these opposite divisions of the year. Besides, as the division of the lunar month, as marked in the almanacs, dissimilar from that of the year, is conformable to its true or natural division;—thence the same difficulty as that between the opposite divisions of the annual circle noticed, does not exist with regard to the lunar circle. And, consequently, calculations in reference to the approaching changes of the weather, founded on the lunar action, according to the division of it to be found in the almanacs, must always, as refers to *time*, be correct.—The division observed in the subjoined chart is simply that of the solstices and equinoxes, or that of its *quarters*, agreeably to its true meteoric division; and into days, as marked by *dots* on the margin. These observations appeared to me to be called for, ere noticing the relative position of the *four storm crises of* 1833, as marked on the chart; their positions in the latter being conformable to their true or meteoric order.

But to resume:—From the context of the preceding observations in reference to the annual circle, it will be seen, simply by means of her dispositions, how abundantly nature has supplied us with data—

when understood—for ascertaining in advance, by the occurrence or non-occurrence of certain meteoric phenomena at particular periods, the nature of the approaching seasons. But that, in common with those supplied by the barometer, in reference to the weather, these appearances, notwithstanding the extent of their relations in the annual circle, partake of the defect of not extending our knowledge *sufficiently in advance.* And that, dissimilar from the barometer, these appearances are of but little account in reference to pointing out *the precise times* at which any remarkable atmospheric phenomena may be expected to occur. But as a sufficiently extended knowledge as to the nature of the approaching seasons, i. e. such as embraces a range of the seasons of *more* than a single annual circle in advance,—can only be obtained by means of calculations founded on the future positions of the superior and inferior planets:—so, a more particular knowledge, as to the precise or probable periods when any remarkable phenomena or changes of the weather may be expected to occur, can only be had by reference to the *lunar action.*—To the consideration of this latter, and the important share it performs in reference to the development of the passing atmospheric phenomena of the day throughout the year, we shall now proceed.

LUNAR ACTION ON THE WEATHER.

THE views taken in the preceding article in reference to the peculiarities in the order of occurrence of electric action in the atmosphere, as connected with the annual circle, are, for the most part, conformable to what, as assumed, would take place, though our earth, similar to those of the primary planets, were unaccompanied by a satellite or moon: and such, consequently, as are to be considered only in this relation, or as being supposed independent of the existence of a lunar influence on the weather. And, as the action of the opposite primary electrical forces in the annual circle, as described, constitutes the ground on which the nature of the lunar influence on the weather chiefly depends;—and this, the lunar influence, during great part of the year—though always present—being no more than a *secondary agency*, as regards the atmosphere and its phenomena;—all that can be attempted in the present article, or, indeed, that it were possible fairly

to expect from science in this particular, will be, to point out the relations, at every period of the year, and under every variety of circumstance,—which the lunar action holds with the other concurring causes that are supposed to exercise an influence on the weather. And, finally, to give such rules, deduced from these relations, and confirmed by observation,—in reference to the order of occurrence of the opposite classes of atmospheric phenomena in the lunar circle,—as will be found at once in conformity with our principles, and, it is hoped, with the great majority of facts.

But it will be right to observe, in this place, that an important distinction requires to be made between the lunar and annual circles of electric action on the atmosphere, in this, that whereas, according to our principles, and as being at once demonstrative of their correctness,—*results*, as refers to the nature of the *approaching seasons*, may be calculated on in advance, *to a certainty:*—owing to the continual changes, relatively, always taking place between the other *concurring causes* connected with latitude and locality, which, together with the lunar action, determine not only the *nature*, but the periods of the *results* of this not exclusively *lunar*, but combined action on the weather;—that, considered as *a guide* to the approaching changes in the latter, —the utmost extent to which, under such circumstances, it were possible to push calculation founded

on the lunar action, will be, not precisely to *results,* or to the *exact periods* of their occurrence, but simply to what may be regarded as *close approximations to both.* But if, as I assume, that in *nine* cases out of *ten,* such calculations,—when the nature of the *localities,*—the season, and latitude, &c., are taken into account,—will be found to correspond with, or closely approach, the anticipated results to which they are directed;—it is easy to see that the balance of utility found to accrue therefrom, will be such, and so important, as not only to recommend their adoption, but to show the propriety of having constant recourse to them, from their general and frequent application. It may be added, that such calculations, instead of detracting from the use of the barometer, were the only thing required, in order to impart to the instrument the full range of its utility. For as such calculations will prepare those who make them, for the nature of the approaching changes; the utility of the barometer will be found, in marking by its indications, the precise periods, as the range or amount of such changes. I have been, indeed, not unfrequently, interested in attending to the various shades of conformity, in the approaches to final and anticipated results in the weather, which, for days together, at times, I have had occasion to observe in the movements of the barometer:—thus supplying that clue —the want of which has been so frequently felt and

complained of, and of which it stood so much in need—to the only true knowledge of the latter. And if I may be allowed to apply the vulgar adage in this instance, that " use makes master,"—it is hardly necessary to add, that the more frequently such calculations are indulged in by any person, the greater the facility, and accuracy, he will acquire from the practice, in making them. But to resume. —Ere entering more particularly into details, I have thought the following summary of principles and general observations not uncalled for, viz. the lunar action on the atmosphere, according to our principles, being of *opposite kinds—positive* and *negative;*—and electric action in the atmosphere being of *opposite species—direct* and *inverse.*—As furnishing a conclusive proof in reference to the existence of a lunar influence on the weather; it will be sufficient to observe, that nearly throughout the year, succeeding lunar tides, positive and negative, are usually marked by *contrasts* in the weather,—whether as regards the temperature, or other phenomena of the atmosphere.—That these contrasts in the weather, during two consecutive lunar tides of different names, are usually greatest about the periods of the equinoxes; and least at, and subsequent to the solstices.—That the lunar action on the atmosphere during the equinoctial quarters,—agreeably to the greater or less influence exercised by the existing currents or winds,—at times develops

itself in the *direct,*—at times in the *inverse* species of electric action; but more usually mixed or blended between both. But that, notwithstanding the formation of rain in the atmosphere sensibly detracts from the effect of the lunar action on the temperature;—yet, that this its effect on the temperature during the equinoctial seasons, i. e. of raising it about the periods of the *syzygies,* and depressing it at the *quadratures,*—is usually so marked, that the only thing to wonder at is, *that the circumstance was not sooner noticed,* and the discovery thence derived sooner made, viz. the analogy subsisting between the lunar action on the tides and temperature; on which the perfecting, not only of meteorology, but of astronomy itself, depended;—requiring, as it did, no more than ordinary attention, to be fully convinced of the existence of this analogy. The circumstance of this analogy, I say, having remained so long unnoticed, might excite our surprise, were it not that the history of science and of the arts abounds with so many similar instances of things obvious to every one *as soon as discovered;*—but which, up to this the period of their being first detected, had remained as completely shut out from human observation, as though they had been excluded by the most impenetrable veil.—Again,—in proportion as from the periods of the equinoxes we approach those of the solstices,—

but more particularly in the countries of the lower parallels in the beginning of summer, and in those of the higher at the commencement of winter,—the *opposite species* of electric action in the atmosphere—*direct* and *inverse*—become gradually more *detached* from each other;—a consequence of which is, that the occurrence of rain and of fair weather, according to the order of their occurrence in the lunar circle, becomes more regular, and strongly marked in the weather. This marked separation of the opposite species of electric action in the atmosphere, thence continues to the period at or subsequent to either solstice, when the force of the dominant action in the annual circle—as in the vicinity of its main focus—is sufficiently powerful to neutralize, as to effects, and merge, the *opposite* action of the moon, or that which *in the order of its occurrence* at the time should induce rain;—but which, owing to the disproportion subsisting between the force of this action of the moon, and that of the dominant action in the annual circle, is no longer sufficiently powerful to produce this effect. Under these circumstances, the lunar action for some time ceases to induce any marked effects on the weather;—which continues to the period after either solstice, when, by the change which has taken place in the relative action of the opposite primary electrical forces in the annual circle, the action of the *subject*, or least powerful of these forces, has

approached so nearly to that of its opposite, the dominant, as that its blending with the lunar action again brings the latter *visibly* into operation on the weather. Owing at once, however, to the central position of these islands, in reference to the opposite extremes of our hemisphere, and their insular position in reference to the waters of the Atlantic,—the extreme action of either primary electrical force in the annual circle, during the periods of their respective domination in winter and summer, is seldom such, as that the changes in the lunar action with us do not induce corresponding changes in the weather:—insomuch, that it (the lunar action,) can hardly be said at any time to be entirely merged in the action of the existing dominant primary electical force in our skies. It happens, not unfrequently,—whether during the development of the equinoctial phenomena in spring and autumn, or about the periods of the solstices—when the *tendency* of electrical action in the atmosphere, as connected with the annual circle, is powerfully to the *inverse species*, and to rain;—and, consequently, that during the period of such tendency, particularly if assisted by the proximity of the sea, or of mountains,—owing to its force being superior to that of the moon,—it has the effect of *blending* the opposite actions of the latter in the weather;—that, under such circumstances, the *accessory phenomena*, such as thunder, storm, &c., by which rain is at times

attended, more than the occurrence of rain itself, indicates the period of the *order of occurrence of rain* in the lunar circle:—as those rains which, during the periods of the year noticed, occur not according to the order of their occurrence in the lunar circle, are rarely accompanied with the violent class of atmospheric, phenomena; whereas, on the contrary, when, as during these periods, the action is powerful in the annual circle,—the rains which occur agreeable to the order of their occurrence in the lunar circle, are usually accompanied with violent accessory phenomena.

The cause of this difference appears to be, that the *site* of the formation of rain in the atmosphere, when it occurs during a period of the homogeneous action of the moon, with that of the existing dominant action in the annual circle, is relatively the *inferior region;* or a little above the region of dew and fog. And thence, owing to a smaller *depth* and volume of the atmosphere being disturbed and put in motion in its production, than during the opposite action of the moon, or when it occurs agreeably to the order of its occurrence in the lunar circle, when the site of its formation is the superior region of the air;—that though such rains are frequently considerable, they are but rarely accompanied with violent atmospheric phenomena. One of the difficulties, indeed, connected with the subject of the lunar action, but more particularly in our variable

climate, is, to be able to determine *in advance* the manner in which the approaching changes of the lunar action are likely to develop themselves on the weather; owing to the powerful influence exercised at times by *local causes;* and, consequently, one which nothing but a previous acquaintance with the nature of the *localities,* can give a facility in determining. In order to this, it will be right to keep in view the nature of the connexion which always subsists between the action of the primary forces in the annual and lunar circles; and that this their action in the latter circle, as in the former, occasionally develops itself in *three ways,* viz. on the temperature;—in inducing the occurrence of rain; and in the winds or currents of the atmosphere:—and that this action, sometimes, though rarely, develops itself in all these three ways *at once;* but that its development is more frequently in but *two* of these phenomena, i. e. on the temperature and currents; or in the formation of rain, and in the currents; in which latter case one of these phenomena has usually the ascendant over the other:—and finally, that there are occasions in which this action develops itself in no more than *one* of these phenomena at the time. Thus, towards the periods of the opposite extreme degrees of temperature in winter and summer, the action of the primary forces in the annual and lunar circles usually develops itself on the temperature alone. At the

periods of the opposite transits of temperature in spring and autumn, the action of these forces in both circles is chiefly developed in the formation of rain:—and again, during the prevalence of the equinoctial phenomena—whether in spring or autumn—in the currents or winds. Thus, by paying attention to these circumstances, and to the period of the year,—it will assist so materially in ascertaining in advance the manner in which the approaching lunar action, whether positive or negative, may be expected to develop itself on the weather, that, after having attained some knowledge by observation, as to the particular influence of the *localities* on the weather, but few mistakes in such calculations need be expected to occur.

So variable, however, are the other concurring causes which, at different periods of the year and in different localities, in common with the lunar action, exercise an influence on the weather:—at times favourable to the just development of the latter action; and, at times again, directly opposed to such development, that a strict analogy may be said to subsist between the changes which take place in the *appearance of the moon* in the different parts of her orbit, and that of her *action on the weather* in different latitudes and localities, at different periods of the year. Thus her influence on the weather, similar to her appearance at *full moon*, is at times fully apparent:—again, as when in her

quadratures, agreeably to the amount of opposing causes,—this her influence on the weather is but dimly, or as it were, but *half* apparent; and finally, as when at the period of *new moon:* when opposing causes intervene to a certain extent,—this her influence on the weather seems totally merged and lost sight of:—notwithstanding that, similar to the moon's *mass in the ecliptic*, her influence on the weather, as on the tides, is never *absent*, or without inducing its effect, whether on the temperature or other phenomena of the atmosphere.

Further, as a total contrast or division in the action of the opposite primary electrical forces in the annual circle, as is known, always subsists between the northern and southern hemispheres, as proved by the opposition in their seasons;—so, as refers to the *lunar circle* of electric action, a partial division in the action of these forces on the atmosphere equally subsists between the continents of the *eastern* and *western* hemispheres: the most palpable proof of which will, probably, be found in the circumstance noticed in pages 243 and 244 of the "Rudiments of the Primary Forces," viz. that the extreme degree of winter cold does not occur in both hemispheres at the same period of time; but *alternately*, after an interval of about *fifteen days*, or half a lunar circle. Which division of electric action between these hemispheres is assumed to have its source in the change which every fifteen days

takes place in the moon's position in the ecliptic, at the consecutive periods of her positive and negative electrical tides. This division of electrical action, however, is not supposed to be restricted to the periods of the extreme degrees of winter cold, or of summer heat; but is assumed to pervade the entire of the annual circle: and to be the cause why two consecutive lunar tides of the *same name* are usually attended by such different results on the weather—circumstances of season and locality being the same—as can only be accounted for in this way. And, as in the case of the extreme degrees of annual temperature alluded to,—it is probable that this division of electric action between the eastern and western hemispheres becomes more conspicuous in the periods of development of the other most remarkable atmospheric phenomena, i. e. the *storm crises* connected with the equinoxes and opposite progression quarters, as marked in the chart, than at other times; or during the periods of development of the ordinary class of these phenomena. The chief characteristic of this division of electric action, however, appears to be, that the same lunar action which induces *rain* with its accessories in, suppose, the eastern hemisphere, induces, relatively, the prevalence of *drought* in its opposite, at the same period of time; and *vice versâ.* And thus that it is confined to the *opposite species* of electric action in the atmosphere. Whether, however, the results

of this division in reference to the action of the moon with either continent at the period of *new* and of *full moon,* &c. be always *invariable;* is more than I can pretend to say. But, as it is a subject which involves interests—whether as connected with science or society—of no ordinary magnitude;—let us hope the period is not distant when, by means of simultaneous observations carried on for some time, both in Europe and America, with this view, it will have obtained all the additional light of which it is susceptible.

Finally, in reference to the *contrasts* which, as already noticed, usually occur in the weather during two consecutive lunar tides of opposite names. As regards ascertaining in advance both the periods, the nature, and extent of the approaching changes of the weather,—the necessity which exists cannot be too frequently inculcated of always recollecting that the periods of the *setting in* of the lunar tides, but more particularly of those which at the time are of an opposite name to the existing dominant action in the annual circle, are the periods at which the lunar influence on the weather is the most *strongly marked.* The reason of this is, that the lunar action towards the conclusion of the lunar tides is that which in general harmonizes with the existing *tendency* of electric action in the atmosphere as connected with the annual circle; and, consequently, that the periods of the succeeding

changes of action in the lunar circle, or setting in of the lunar tides, as they interrupt or present a directly opposite action on the weather to that by which they were preceded; thus it is that the lunar changes, at, or immediately following the *octants*, or setting in of the lunar tides, usually induce these marked contrasts noticed, in the weather. The *duration* of such changes, however, will be of shorter or longer continuance, agreeably to the greater or less amount of the existing tendency of electric action in the annual circle at the time; the greater the amount of such tendency,—the *shorter* being the duration of the changes of the weather induced by the lunar changes; but, in general, *the more violent* the accessory phenomena by which they are attended; and *vice versâ*.—Thus it is, at the commencement of winter, that when the tendency of electric action in the annual circle is strongly to *frost*, and that the negative lunar tide from being of the same name helps to develop this tendency on the weather, that the change in the latter which immediately succeeds at the setting in of the positive lunar tide subsequently, is, in general, accompanied with violent, though short-lived *storm*. And that when, at the latter season, the tendency to frost in the annual circle is not powerful, as in mild winters, that such storms instead of occurring, as under opposite circumstance, at the commencement of the positive lunar tides,—usually occur at or sub-

assist in such calculations,—(together with keeping in view the *exact period* of the year to which they have reference, and the peculiar *tendency* of meteoric action in the atmosphere at such period, as connected with the *annual circle*,)—than a knowledge of the *tendencies* of electric or meteoric action, *as they exist,* in the *lunar circle*—whether to *drought* or *rain.* And, that a separate article on this subject was esteemed necessary in treating of the annual circle; I have thought it right to devote a short space here to pointing out these the variations in the meteoric tendencies of the different parts of the lunar circle; together with the changes which, immediately after the solstices, take place therein.

The parts of the annual circle when, only, correct ideas can be formed as to the natural tendency of each part of the meteoric tree to which the lunar circle has been compared, is divided, are, as stated elsewhere, those of the summer and winter *progression quarters;* from these being the sole periods of the year when, by the ascent of the dominant action, combined with the consecutive increase in the length of the day or night, with which it is connected, a *ground of projection* is afforded, by which the varying meteoric effects, induced by its different parts, are distinctly and fully developed in the passing atmospheric phenomena of the day. And, consequently periods is found to be

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rudder to the *parent stock;* i. e. the extended and more powerful meteoric tree formed by the existing dominant action, or half-yearly tide, in the annual circle. For, though the lunar action is always determined in its effects on the weather, by the existing action in the annual circle and nature of the *localities:* yet, it is according to this the influence which, under all variety of circumstances, it exercises on the weather, that the leading phenomena in the latter, throughout the year, are uniformly determined *in the periods of their development:*—the latter being, perhaps, the most important meteoric effect induced by the lunar action on the atmosphere. But, *Proteus* like, the meteoric action of the moon on the latter, changes appearances continually with the change of circumstances in the annual circle, and change of the localities; and herein lies the difficulty of keeping pace with it, so as that it does not elude or evade expectation in the anticipation that may be formed of it. The lunar influence on the weather, however, when well understood, is always, as to its effects, *consequent,* or that which, under the peculiar nature of the circumstances, it should be: insomuch, that it has not unfrequently happened to me to have been *first* recalled by the phenomena themselves, to oversights, or errors of calculation I had fallen into, in reference to approaching changes in the weather. And, as nothing will more materially

assist in such calculations,—(together with keeping in view the *exact period* of the year to which they have reference, and the peculiar *tendency* of meteoric action in the atmosphere at such period, as connected with the *annual circle*,)—than a knowledge of the *tendencies* of electric or meteoric action, *as they exist*, in the *lunar circle*—whether to *drought* or *rain*. And, that a separate article on this subject was esteemed necessary in treating of the annual circle; I have thought it right to devote a short space here to pointing out these the variations in the meteoric tendencies of the different parts of the lunar circle; together with the changes which, immediately after the solstices, take place therein.

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lunar circle, as expressed in the weather, is what should be considered as constituting the *rule*, in reference to the natural meteoric tendency of such part; and *vice versâ.*

Now, on these principles, and considered in this point of view, a marked analogy will be found to subsist between the lunar meteoric tree in its development; and that formed by the action of either primary force in the annual circle during the period of its domination, as we observe it extending from the *main focus* of this action, at either extreme of the hemisphere, which constitutes its root,—along the *ascending scale* of latitude in summer; and opposite or *descending scale* in winter: i. e. that the relative meteoric tendency of the *root and trunk* of the former, as latter, is to the *direct* species of electric action in the atmosphere, and to *drought*; and that the meteoric tendency of its opposite division, or summit, is, on the contrary, to the inverse species, and *rain:* circumstances of latitude and locality being the same. And, as the lunar circle consists of *two positive* and *two negative* meteoric tides, which consitute its opposite grand divisions: and that, as the order of occurrence of rain during the summer progression quarter, as refers to the lunar circle, is during *its negative,* as in the winter progression quarter during its *positive tides:*—thus that, during the former, or summer progression quarter, more rain will be found to fall during the

negative lunar tide of the ***second,*** than during that of the ***first*** lunar quadrature; as during the opposite or winter progression quarter,—during the positive lunar tide of ***full,***—than the positive lunar tide of ***new moon:*** other circumstances being the same. Thus proving the difference of relative meteoric ***tendency,*** as stated, subsisting between the root and trunk of the lunar meteoric tree, as extending from the commencement of the positive tide of ***new moon*** to the conclusion of the negative tide of the ***first quadrature,*** or first half of the lunar circle; as contrasted with the opposite, or summit of this its meteoric tree,—extending from the commencement of the positive tide of ***full moon,*** to the conclusion of the negative tide of the ***second quadrature.***

This order in the relative tendency of meteoric action in the lunar circle, however, as it properly dates its commencement with that of each of the progression quarters in the annual circle; so, likewise, it concludes with these quarters at the periods of the solstices;—owing to the sudden loss which, immediately after these periods, takes place in its ground of projection; incident to the falling off in the length of the day in summer, and in the length of the night in winter. And, as in reference to the opposite progression quarters, this the meteoric tendency of the different parts of the lunar circle is more fully developed as we advance; and as a consequence,—towards their conclusion, than at their

commencement. So, the contrast presented by the lunar action to the preceding order in its tendencies, which occurs during the succeeding *transition quarters* in the annual circle—extending from the solstices to the equinoxes,—is greater and more strikingly apparent at their commencement, or immediately subsequent to the solstices, than in their opposite extremes as we approach the equinoxes. And thus, as the *sixth,* and *twelfth* moon in the annual circle, or those which occur at the close of its opposite progression quarters, may be considered as those during which the development of the meteoric tendencies in the lunar circle, as stated, is most apparent; so the *seventh,* and *first* moon, or those which follow next immediately after the solstices, are those during which the greatest derangement in the previous meteoric tendencies in the lunar circle occur. This, the loss of its ground of projection in the annual circle at the solstices, causing that immediately after, the disposition in the relative meteoric tendency of its parts, in the lunar circle, becomes *altogether reversed* or *inverted*:—the half of the lunar circle which before the solstice tended, as stated, most to drought, being that which immediately subsequent tends most to rain; and *vice versâ.*—And the periods of the *setting in* of the lunar tides, instead of those of their going out, or *conclusion,* as before the solstices, being now those of *the most violent gales,* and other similar atmos-

pheric phenomena. In the lunar circles which follow, however,—in proportion as we approach the equinoxes, the natural order in the meteoric tendencies of their parts will be observed gradually to regain its lost equilibrium:—till at, and subsequent to the latter periods, it becomes fully restored.

It may be further observed, that, as refers to the various species of atmospheric phenomena, there are certain latitudes and localities more favourable to the development of each particular species than others. And that in this way it is, that during winter, from the tendency of the weather in the annual circle in the higher latitudes, being more to drought than with us; those are the latitudes during winter which are most favourable for observing the effect induced by the negative action of the moon in lowering the temperature: as, for a similar reason, the lower latitudes during summer are more favourable than ours, for observing the effect of the positive action of the moon in raising the temperature.* On the other hand, the central lati-

* I may here notice a recent instance of this:—On Tuesday the 8th of July, 1834,—being the second day after the period of *new moon*,—Chevalier's thermometer at Paris, marked as high as $21\frac{6}{10}$° R. or $80\frac{1}{4}$ deg. of Fahrenheit, (see *Courier* of the 11th July, 1834:) while at and subsequent to this period in Dublin, where I was at the time, the daily occurrence of rain prevented this the positive action of the moon from inducing any such rise in the temperature.

tudes are, perhaps, those most favourable for observing throughout the year the variations of *tendency,* as described, of the different parts of the lunar circle, on the weather. And thus, owing to our central position, which causes that the *contrasts,* both in winter and summer, between the action of the opposite forces, solar and planetary, in the annual circle, are *less* with us, than in the countries lying further north or south: and that our insular position causes a greater tendency to rain in our skies, than what occurs within the same parallels on the continent. This causes that the lunar action, as it exercises a more extensive influence on the weather with us, than even within the same parallels in the continent;—likewise causes, as refers to the peculiar meteoric tendencies of the different parts of the lunar circle,—that they are more clearly distinguishable and marked with us, than, perhaps, elsewhere.

It may be further observed that, as there occurs a difference of tendency in reference to drought and rain, between the commencement or first half of the lunar circle, and its conclusion:—so, likewise, a very marked difference of tendency is observable in the *accessory phenomena,* by which the rains which occur during these opposite divisions of the lunar circles are attended. For whereas, particularly during spring and early part of summer, the rains which occur during the *first half* of the lunar circle,

are, more generally, accompanied by *thunder*,—being an effect of its meteoric tendency to drought,—than those which occur during the opposite or concluding half;—the rains, on the contrary, which during this season, occur during the *latter half* of the lunar circle, but more particularly towards the conclusion of the negative tide which terminates it, are equally remarkable for being attended with *storm*,—being likewise an effect of its meteoric tendency to rain,—but unaccompanied by thunder.—Some of the most destructive gales and tornadoes, indeed, of this part of the year, usually mark the conclusion, or going out of the lunar circle:—witness the destructive gale in the vicinity of London, which occurred on the 14th of June, 1833, as will be found noticed elsewhere;—and the still more recent and destructive tornado, attended with loss of life, &c., at and in the neighbourhood of Petersburg, Virginia, on Monday, the 5th of May, 1834,* being the *fifth day* after the period of the *second quadrature* of the moon, or extreme limit of the lunar circle.

* For an account of this tornado, see *New York Courier*, of the 12th May, 1834.

LUNAR CIRCLE *in its connection with the* ANNUAL.

These circumstances premised, we shall at once enter on our tour of observations, in reference to the lunar action on the weather throughout the year; commencing with the winter solstice.—The increased difference between the relative force of the existing dominant action in the annual circle, immediately after the winter solstice, (the negative of the earth,) and that of the moon, incident to the growing concentration of the former action on the temperature, with the gradual increase in the length of the day, combined with the loss of its *ground of projection* in the annual circle, sustained by the latter,—this the lunar action, for some time, as stated in a preceding article, loses much of its accustomed influence, in reference to inducing changes in the weather. And as its action, in consequence, is chiefly confined to the temperature, and that it is the increasing force of the solar action, as stated, which, by inducing the concentration of the existing dominant action in the annual circle, brings on the extreme degree of winter cold;—that the action of the same name in the lunar circle, is that, necessarily, which adds most to the force of the solar action at the time. Thus it is, that it not unfrequently happens—particularly in mild winters, when the dominant action is feeble in the annual circle,—that the first frosts after the winter solstice, set in with either of the positive lunar tides, preceding *new,* or *full moon.* Furnish-

ing, as the circumstance does, an instance of these seeming anomalies, or *inversion of effects*, which, owing at once to the nature, and to the principles by which the forces that preside over the temperature and other phenomena of the atmosphere are governed, occasionally occurs in the development of these their effects:—as, likewise, an instance of the species of obstacles which had to be surmounted in the prosecution of such inquiries, ere arriving at a correct knowledge of the source of such apparent contradictions. During severe winters, however, owing to the lunar action, positive and negative, being for the most part merged in the existing dominant action, the effects of the lunar action on the temperature at this period, are less perceptible. It may be observed, however, that, particularly in severe winters, the period of extreme cold usually occurs at either of the lunar *quadratures*;—which, as the period when it occurs is *after* the solstice, is considered less an effect of the negative action of the moon,—as would be the case *before* the solstice, than of the extreme concentration of the preceding positive lunar tide, induced by the setting-in of this the negative tide by which it is succeeded,—it being the only exception throughout this the winter season, in which the positive action of the moon, according to the order of its occurrence in the lunar circle, does not induce *rain*, instead of drought.

From after the period of the extreme degree of winter cold, to the occurrence of the chief *storm*

crisis connected with the vernal equinox:—owing to the loss of its ground of support or *projection* in the annual circle, the lunar action on the weather does not appear to be controlled by any fixed law, other than that of the *inversion in the order of its effects*, noticed in the preceding article. And, consequently, during this interval, the only circumstance which appears to hold good in reference to the lunar action, considered as a guide, is that of the *contrasts*, consecutively, which usually occur in the weather at the periods of the *syzygies* and *quadratures*, viz. when during this period the weather is fine at the *quadrature*, rain, and its accessory *storm*, usually occur at the period of the succeeding lunar *syzygy*, and *vice versâ*. The circumstance, however, subsequent to the period of the lowest degree of winter cold, as connected with the meteorological progression of the ensuing season, which should more particularly engage the attention of persons whose avocations are more immediately connected with the weather, is that of the *chief storm crisis*, connected with the vernal equinox. But as the period of its occurrence will, as I feel warranted in assuming, be, in a great measure, found governed by the range of temperature during the preceding winter;—this, in the first place, will serve to aid calculation in reference to the period when it may be expected to occur:—and that the species of dependance noticed, really subsists, the following facts, it is hoped, will sufficiently prove:—After the severe winter of 1829-30,

when, on the morning of the 18th January, as already noticed, the cold in London was 27° below the freezing point,—the chief storm crisis connected with the following vernal equinox, did not occur till the evening and night of the 19th April, or 109th day of the year,—being, as connected with the lunar circle, the *third* day following the period of the *second quadrature,* or going out of its negative tide:—the heavy gale and rain on this occasion having been accompanied with thunder. After the following winter of 1830-31, the period of the greatest cold of which occurred on the morning of the 25th of December, when the thermometer at Paris marked 14° below the freezing point:—the storm crisis connected with the succeeding equinox, occurred on the 13th of March, or 72nd day of the year, being the eve of new moon;—this gale, on the coast, having been terrific, and accompanied with lightning.—While, after the mild winter of 1832-33, this the chief storm crisis connected with the vernal equinox, occurred so early as the 19th and 20th of February, or 50th and 51st days of the year. It may be further observed, that the intensity or relative degree of violence of the phenomena of this storm crisis, appears, likewise, in some measure, to correspond with the temperature of the preceding winter; being most violent after severe winters, and *vice versâ.* It is further worthy of remark, in reference to this the first storm crisis of the year, that, as the action in which it has its source, is chiefly connected with

the *annual circle*,—and, consequently, from being superior in force to the lunar, has the effect, during its continuance, of merging, to a certain extent, the latter action on the weather;—that, as if by a provision of nature, in order to give notice of its approach, it is not unfrequently preceded, for some days, either by the appearance of the *aurora borealis*, or by one of those *hoar frosts*, which, as will be found noticed elsewhere, are so frequently the precursors of storm during the winter season. Thus, the terrific gale of the 13th of March, 1831, noticed, was preceded, for the space of four days, at Dublin, i. e. at one o'clock, on the morning of the 9th of March,—by an *aurora*:—being at the going out of the negative lunar tide of the *second quadrature*, on the 6th; and the gale of the 19th February, 1833, and period of *new moon*, by which no less than fifty-one ships were lost in our seas, as stated in the papers, was preceded on the night before by hoar frost.

As in nature, however, that all *superlatives* have their *diminutives*, thus it is, that though the vernal equinoctial season has its chief storm crisis, this is not meant to imply that the latter is not both preceded and followed, at intervals, by gales of minor force. But, as with the recovery of its ground of projection in the annual circle, at the period of the vernal equinox, the lunar action on the weather gradually recovers its just equilibrium,—as soon as the equinoctial phenomena have passed, the opposite effects of the lunar changes, consecutively, in refer-

ence to the occurrence of such gales and of fair weather,—become, in general, as regularly and fully developed in the passing atmospheric phenomena of the day, as though the latter were—as is the case—the consecutive results of the most perfect mechanism. Thus, notwithstanding the occurrence of the chief storm crisis connected with the vernal equinox, so early as the 20th of February, as we perceive may be expected after mild winters, it is rarely the case, that any long continuance of fair weather at this period of the year, occurs before the setting-in of the *new moon* in the month of April;—as from this period only can, with certainty, be dated, the setting-in of the north-east wind in our skies *as a periodical:* this, the moon which commences in April, owing to the parching effects on vegetation, induced by this periodical wind, of which it has long been observed to be the harbinger, being called by our neighbours, the French, *la lune rousse,* or red moon. For, as refers to the north-east wind,—though after *mild* winters, as was the case in 1834,—it may set in for some time with the new moon in the month of March; such commencement, as was the case in the latter year, is sure to be succeeded by high gales and rain at the setting-in, and during the positive lunar tide of full moon by which it is succeeded. And it is worthy of remark, that at no period of the year, perhaps, is the circumstance, noticed in a preceding paragraph, in reference to the division or opposite tendency of electric

action assumed to subsist between the opposite extremes or sides of the lunar circle, noticed in the preceding article, more fully developed, in the weather, than at this. For, as the period of *new moon* is almost sure to bring with it the setting-in of the north-east wind and drought; which, up to the setting-in of the succeeding positive lunar tide of full moon is seldom interrupted by rain, except, perhaps, briefly at the period of the setting-in of the intervening negative tide of the first quadrature:—this the positive tide of full moon is almost sure to bring with it a change of weather to rain, accompanied, probably, with gales of wind. Which tendency will be found to go on progressing to the conclusion of the succeeding negative tide of the second quadrature; after which, with the setting-in of the succeeding positive tide of new moon, a return to drought will be found to succeed; and so *alternately*, once the order of occurrence of these opposite tendencies of the weather, in reference to the opposite divisions of the lunar circle, becomes established for the season. I cannot, it is true, from the observations I have been able to give the subject, take on me to say, that the preceding order of these phenomena, may not, in some years, be *reversed*, i. e. of having drought set in with the positive tide of full *moon*, and rain with the positive tide at the period of the *change*:—the latter order, however, from its unfrequency,—if,

indeed, it occurs at all, will be found but as the *exception,*—whereas the former may be considered as the *rule.*

It is further worthy of remark, as being another instance of the *inversion* of results, as refers to the natural effect of the action of the primary electrical forces on the temperature and weather, which, under peculiar circumstances, as noticed in a preceding paragraph, occasionally arises, whether from the partial operation of the laws which govern the action of these forces, or the local and temporary effect of the currents to which, at particular seasons, the inequality of their collective agency on the body of the atmosphere, gives birth. The north-east wind, in spring, being, as it is, brought on by the increasing force of the solar action, the *positive* lunar tide, as being of the same name with the positive action of the sun,—by the accession of force which it brings to the latter, should, if our principles were correct, be that which first originated this periodical wind. And accordingly, we find, whether it be in March or April, that the period of the setting-in of the north-east wind, is always at or about the *change* of the moon, when its positive action is most powerful:—and that the force of this wind diminishes with the progression of the succeeding negative lunar tide at the *quadrature.* But such is the inversion of results on the temperature connected with the north-east wind, that, during its continu-

ance, it is by no means unusual, at times, to have the cold *by day* greater than *by night*:—and as a further consequence of the action of this wind, the positive lunar tides which originate it, instead of inducing, as in its natural development should be the case, a *rise of temperature*;—it, on the contrary, is accompanied with an *increase of cold*. Whereas, the falling off in the force of the north-east wind alluded to, with the progression of the succeeding negative lunar tide, incident to the decrease of force in the lunar action,—instead of inducing, as on the tides, a fall of temperature,—the latter, on the contrary, increases, in a ratio exactly proportioned to the decrease in the force of the lunar action, and north-east winds. As showing, however, during the prevalence of the latter, the natural action of the moon on the temperature,—though the latter by day is, as stated, usually higher during the negative than the positive lunar tides; yet, though *frost* is rarely seen during the positive, it is of common occurrence, nightly, towards the close of the negative lunar tides.

It is hardly necessary to add, that, together with the chief storm crisis connected with the vernal equinox falling later, in proportion to the greater severity of the preceding winter; so likewise, the stormy and bad weather at this period of the year, extends farther into the season after severe than mild winters.—It further follows, that from the

force of the *mean* action of the moon on the atmosphere, as on the waters of the sea, being invariable; while the mean relative action of the opposite primary electrical force, in the annual circle, not only varies with the latitude and locality of places, and change of the season of the same year, but with the changes which occur in the seasons of different years; and that the existing *tendency* of electric action in the atmosphere, as connected with the annual circle, whether to rain or drought, and the various degrees of such tendency throughout the year, are, at all times, exactly proportioned to the force of the dominant action in the annual circle in which they originate; and, consequently, that the force of such tendency is frequently superior to the action in the lunar circle which is opposed to it. Thus, it is, that the effects produced by the lunar action on the weather, can never be other than *relative*:—as when the existing tendency of electric action in the annual circle is such, as totally to merge, or blend in it the opposite action of the moon, the effects of the latter on the weather, becomes either totally, or to a certain extent suspended; and, of course, cannot, under such circumstances, be counted on. From this, it follows, that it is only within a certain range of the relative action of the opposite primary electrical forces in the annual circle, and of the existing tendency of electric action in the atmosphere, that the natural

effects of the lunar action on the temperature and weather at any season can develop themselves. And thus it is, that, as after severe winters, the opposite actions of the moon are, for some time, either totally merged, or blended in the phenomena connected with the vernal equinox; so, on the other hand, after mild winters,—from the period of the setting-in of the north-east wind, subsequent to the equinoctial phenomena,—owing to the tendency to drought in the atmosphere being such, as partially to merge in this tendency the opposite action of the moon on the weather; the lunar changes for some time are not, as under ordinary circumstances, attended by corresponding changes in the weather. And that, as with the advance of the season, the amount of this tendency to drought increases, even when the lunar action on the weather continues to be perceptible,—that the periods at which the lunar tides inducing changes to rain, effect such changes, recede or fall back from their commencement to later periods, when the force of these tides, from its growing increase, at length, by overthrowing the existing equilibrium of the dominant action in the atmosphere to which it has been opposed, effects a change in the weather. Thus establishing, by facts, in a manner the most conclusive, that the principles which, on the one hand, retard or neutralize, and those which, on the other, favour and accelerate the just development of the lunar action on the wea-

ing, as the circumstance does, an instance of these seeming anomalies, or *inversion of effects*, which, owing at once to the nature, and to the principles by which the forces that preside over the temperature and other phenomena of the atmosphere are governed, occasionally occurs in the development of these their effects:—as, likewise, an instance of the species of obstacles which had to be surmounted in the prosecution of such inquiries, ere arriving at a correct knowledge of the source of such apparent contradictions. During severe winters, however, owing to the lunar action, positive and negative, being for the most part merged in the existing dominant action, the effects of the lunar action on the temperature at this period, are less perceptible. It may be observed, however, that, particularly in severe winters, the period of extreme cold usually occurs at either of the lunar *quadratures*;—which, as the period when it occurs is *after* the solstice, is considered less an effect of the negative action of the moon,—as would be the case *before* the solstice, than of the extreme concentration of the preceding positive lunar tide, induced by the setting-in of this the negative tide by which it is succeeded,—it being the only exception throughout this the winter season, in which the positive action of the moon, according to the order of its occurrence in the lunar circle, does not induce *rain*, instead of drought.

From after the period of the extreme degree of winter cold, to the occurrence of the chief *storm*

crisis connected with the vernal equinox:—owing to the loss of its ground of support or *projection* in the annual circle, the lunar action on the weather does not appear to be controlled by any fixed law, other than that of the *inversion in the order of its effects*, noticed in the preceding article. And, consequently, during this interval, the only circumstance which appears to hold good in reference to the lunar action, considered as a guide, is that of the *contrasts*, consecutively, which usually occur in the weather at the periods of the *syzygies* and *quadratures*, viz. when during this period the weather is fine at the *quadrature*, rain, and its accessory *storm*, usually occur at the period of the succeeding lunar *syzygy*, and *vice versâ*. The circumstance, however, subsequent to the period of the lowest degree of winter cold, as connected with the meteorological progression of the ensuing season, which should more particularly engage the attention of persons whose avocations are more immediately connected with the weather, is that of the *chief storm crisis*, connected with the vernal equinox. But as the period of its occurrence will, as I feel warranted in assuming, be, in a great measure, found governed by the range of temperature during the preceding winter;—this, in the first place, will serve to aid calculation in reference to the period when it may be expected to occur:—and that the species of dependance noticed, really subsists, the following facts, it is hoped, will sufficiently prove:—After the severe winter of 1829-30;

in the annual circle and the lunar action; the latter, from being, to a certain extent, merged in the former, combined with the *inversion* in the order of its effects on the weather, as during the opposite season of the year,—is no longer, as before, *regular* :—and, consequently, considered as a weather guide, is no longer to be relied on. Thus, the most violent hurricanes in the West Indies during this season, as thunder storms in Europe, not unfrequently occur altogether out of the preceding order of their occurrence as connected with the lunar circle, i. e. at or about the period of the lunar *syzygies*. But, in proportion as from after the period of the highest degree of summer temperature we approach the autumnal equinox, the same as at the opposite period of the year, the uncertainty which the previous disproportion between the action in the annual and lunar circles had induced, in reference to the lunar influence on the weather, gradually subsides with this its cause; thence giving place to greater regularity and certainty of effect in reference to this influence,—the inversion in the order of its effects, however, still to a certain extent being observable. A proof of this change will be found—more particularly during wet summers—in the circumstance, that when in August and beginning of September the *tendency* is to rain in the annual circle;—and, as being a consequence of the latter, that rains not unfrequently

occur in our skies about the period of *new* and *full moon*; that as such rains are not according to the order of their occurrence in the lunar circle, being simply an effect of the existing tendency in the annual, they are rarely heavy, or attended with violent accessory phenomena: but, as proving the nature and extent of the lunar influence at this period on the weather,—the order of occurrence of rain at the time being during the *negative* lunar tides,—when, under these circumstances rains occur about the periods of the lunar syzygies, much heavier rains, accompanied with gales of wind, as observed elsewhere, will be found to occur at and subsequent to the ensuing lunar *quadratures*:—provided, as is not always the case, that the rains, &c., at the syzygies, are not connected with the phenomena of the approaching equinox. During the greater part of the summer transition quarter, however, similar to the same season in winter, and up to the period towards its conclusion, when, as noticed, the lunar influence has commenced the recovery of its lost equilibrium; almost the sole rule connected with the lunar action on the atmosphere, which can serve as a guide to the approaching changes of the weather, is that founded on the *contrasts* in the latter, which, throughout this season, usually, mark the periods of the lunar syzygies and quadratures consecutively: these contrasts, however, during dry summers are not so frequent or

remarkable. This the recovery of its equilibrium by the lunar action on the weather, except as noticed, while interrupted by the occurrence of the *third storm crisis,* and other phenomena connected with the autumnal equinox, will, from towards the conclusion of the summer transition quarter be observed to go on progressing with the advance of the season, till about the middle of September, when it may be considered as fully established. And thence, during the continuance of the *Michaelmas summer,* i. e. to the beginning of November,—owing to the absence, relatively, of periodical currents, similar to the N. E. wind in spring,—this, as already noticed, is the most favourable part of the year for observing the analogy assumed by our theory to subsist between the lunar action on the tides and temperature; as likewise the lunar influence in reference to the opposite species of electric action in the atmosphere. For, as during this period the tendency for some time, as connected with the annual circle, is to *drought*, and that it is the weather towards the conclusion of the lunar tides which, throughout the year is in accordance with, and consequently constitutes the *rule* in reference to this the existing *tendency* in the annual circle, as stated; and that the weather at the periods of the lunar changes, or which immediately follows the octants, i. e. the commencement of the lunar tides, is that which is usually in contradiction with, and constitutes the

exception to this rule. Thus it is that during the Michaelmas summer, the setting in of the lunar tides is, in general, marked by the occurrence of rain; but that, as they advance, these temporary rains clear off, and are succeeded by fair weather to their close: being accompanied with a *rise of temperature* during the *positive,* as by *a fall* of temperature during the negative tides, agreeably to the nature of each.

To the Michaelmas summer—of which properly speaking this latter is but the commencement—succeeds the *winter progression quarter,* and chief *storm period* of the year;—on which account chiefly it is, that this part of the annual circle merits all the consideration, and aids that science and observation can bring to elucidate one of the most important subjects connected with meteorology. One indeed, which if successful in, as it was the great object whose attainment first stimulated me to enter on this department of science; and I may add, with a "desperate fidelity,"—through good and through evil report,—to persevere in, during so many years: it is one the attainment of which is of sufficient magnitude to compensate me for the time and labour bestowed on the subject. For if, as I anticipate, that a result of my industry will be to cheer with well founded confidence the mariner in his midnight watch as he wanders over the pathless deep, by pointing out to him when he has

nothing to apprehend from storm; and, on the other hand, by apprizing him in advance of the moment of danger, to arm him for the coming conflict.—To have been, I say, the humble means of effecting benefits of such magnitude to suffering humanity as these, might well compensate for the labour of a whole life; and enable me to overlook the difficulties that had to be surmounted, equally as those obstacles—not a little onerous—which the childish workings of caprice or prejudice have from time to time conjured up, as it were, to impede my advance, by disgusting me with the pursuit. But of this enough.

The elements more immediately connected with the present part of our subject are the following, viz. the connexion which, during the winter as the summer progression quarter, subsists between the phenomena of atmospheric *temperature* and *storm:* the connexion, as stated, which throughout the year subsists between the existing *tendency* of electric action in the atmosphere as connected with the annual circle, and the difference between the weather at the setting in, as contrasted with that at the conclusion of the lunar tides,—and the *rule* in reference to the lunar action, as cited, founded thereon: and finally, the order of occurrence of rain and fair weather, and divisibility of electric action in the atmosphere between the eastern and western hemispheres, as connected with the lunar circle.

Thus, it will be perceived this subject is not a little complex; yet not so much so but that, when explained, the most ordinary capacity may fully understand it. But as a knowledge of first principles can only be obtained by paying attention to these circumstances, and a key to the lunar action on the weather during the winter progression quarter thereby be found; these considerations will be sufficent to induce those who may feel disposed to turn their attention to the subject not to overlook them. And as the assumed connexion between the principle of temperature throughout the entire atmosphere of either hemisphere, and the lunar action,—as being both in winter and summer the chief *moteur* in originating storm during these seasons,—will be found treated of at large in another part of the work; in order to avoid needless repetitions, I must beg to refer the reader to number 16, and other of the "General Observations" which he will find under this head, at the conclusion of the volume; in which he will perceive the nature of the connexion and dependence alluded to between the principle of temperature, and the lunar action on the weather:—and why it is that the same lunar tide, at the same period of time, induces such variable effects on the weather, along the ascending and descending scales of latitude during the same season, whether in summer or winter; and within the same parallels during the same seasons of

different years, according to the difference of their seasons. And this, it is hoped, in such way, as to satisfy him that, any thing in the shape of ambiguity or doubt, can no longer be said fairly to attach to these subjects.

These circumstances premised,— a recapitulation of such as are more immediately connected with the subject of storm during the winter progression quarter, will be sufficient in this place:—under the point of view which, in reference to the winter progression quarter, goes to show the connexion subsisting between the principle of temperature and the lunar action on the weather. The *meteoric tree* to which, in Observation 16, the dominant action in the annual circle on the body of the atmosphere collectively of our hemisphere, during this season, is compared; is, similar to other trees, divisible into opposite parts, viz. a trunk, and its extended branches:—the former having its root at the pole or main focus of the negative action of the earth, from which its opposite divisions extend southwards, along the continents of Europe and Asia to the east, and that of America to the west,—to the middle latitudes; while the branches, tapering as they advance, extend thence into the lower latitudes, and tropical skies. The distinguishing characteristics of these opposite divisions being, that as far as the trunk extends southwards on either continent, the tendency of electric action in the atmosphere, as

connected with the annual circle, *is to drought;*—whereas, throughout the more extended regions traversed by its branches, the tendency of electric action at the same period, is to *humidity:*—as what in the tropical skies and lower latitudes, is known by the name of the *rainy season,* is, as is known, the season of unchangeable *frost* in the higher latitudes. Thus, it will be perceived, as regards the meteoric effects on the weather connected with these opposite divisions of this extended electrical battery, they present the strongest contrast;—being directly opposite one to the other. And the necessity which exists of attending to this division of electric action in the opposite regions of our hemisphere will sufficiently appear, when, on it, as I hope to show, the solution of the important, and long discussed problem of the lunar action on the weather, as refers to this the winter progression season, may be said chiefly to depend. As, however, the growth and expansion of this electrical tree, may be said to date from the period after the autumnal equinox, when the first frosts of winter set in in the higher latitudes; and, consequently, that the portion of it we have denominated the trunk, is at first limited to a few degrees of latitude in the vicinity of its root, or the main focus of the negative action of the earth at the pole:—from which latter, with the advance of the season, this its trunk gradually extends itself further south; till, at the period of the lowest de-

gree of winter temperature or greatest cold, it has attained the utmost extent of its growth, or range southwards:—and further, that the extreme degree of winter cold is not always the same, varying, as it generally does, with the seasons. Thence the range or extension of the *trunk* of the electrical tree southwards, not only varies with the different periods of the same winter progression quarter, but with the winter progression quarters of different years. And, as a consequence, were it not that a solution of the enigma were supplied by the weather itself, one of the difficulties connected with the lunar action on the latter, at this period of the year, would be, to determine, with precision, the point on the descending scale of latitude where the trunk of this electrical tree terminated, and its branches commenced; the more important to be known, as on this circumstance, as will shortly be made appear, the immediate effect on the weather, induced by the lunar action, will depend. However, as the phenomena of the weather itself, as alluded to, will supply an infallible clue in pointing out the positions occupied by the opposite divisions of this electrical tree or battery, simply by the nature of the contracts it will present at the commencement and conclusion of—more particularly—the *positive* lunar-tides: and that, as refers to the range occupied by its trunk, when once its extreme limit is ascertained, its effect during the remainder of the season within this range will

be found invariable. Thus, a slight attention is all that will be necessary in order to determine at any period of the winter progression season, and in all variety of locations, these important points. The necessity for being so particular in reference to ascertaining the precise limits of the opposite divisions of this electrical or meteoric tree, is, that as the *tendency* of electrical action in the atmosphere embraced by either, as refers to the annual circle, is, as stated, in direct opposition to the other; and that, as refers to the lunar tides, the periods of *contrast* in the latter to the existing tendency in the annual circle, are those of their commencement or setting in; and of the accords in the weather with this tendency,—towards the periods of their conclusion:—thence, that, so soon as the limit of each division of this electrical tree is ascertained,—as effect follows cause—no difficulty can any longer exist in reference to ascertaining in advance, the periods in the lunar circle when the violent class of atmospheric phenomena may be expected to occur; —and consequently those, during which no apprehension as to the occurrence of the latter phenomena need be entertained. Nature, in reference to the principles which govern this the violent class of atmospheric phenomena in the periods of their development, being, when the latter are once ascertained, equally simple and consequent, as in her other operations.

Now, granting our assumptions to be correct, it will follow, in the first place, that the order of occurrence of rain, with its accessories, storm, &c., during the winter progression season, as refers to the lunar circle, is during the positive lunar tides of *new* and *full moon.*—That in the higher latitudes of our hemisphere where during this season the tendency of electric action in the atmosphere as connected with the annual circle, is to *drought;* and where, consequently, the order of occurrence of the *exceptions* to this tendency, as refers to the lunar circle, is at the periods of the *setting in* of these the positive lunar tides; and further, that this the effect on the weather induced by the setting in of the positive lunar tides has its source in the temporary interruptions, and incidental *shocks* given to the progressing course of meteoric action in the annual circle, by the sudden changes of electric action in the lunar, at these periods, *from negative* to *positive;* which, by overthrowing the previously existing equilibrium of the *direct* species of electric action in the regions of the atmosphere where they occur, necessarily bring on the opposite or inverse species of this action, and formation of rain with its accessories of storm, &c. But, as the force, and consequent effect on the weather thus induced by the lunar changes from negative to positive, must be in a ratio proportioned to the degree of *contrast* subsisting between the opposite actions in the lunar

circle at the periods of these changes;—were this contrast greater at the period of the setting in of the positive lunar tide of *new,* than at that of *full moon;* owing to the relative force of the negative tide of the *second* lunar quadrature being greater than that of the *first,* as the positive tide at the period of *new,* being more powerful than that at the period of full moon. Thence, assuming these differences in the relative force of the lunar tides really to subsist,—it would follow, according to these principles, that during this the winter progression quarter,—as the periods of the occurrence of storm, in reference to the lunar circle and higher latitudes of our hemisphere, were those of the setting in of the positive lunar tides,—owing to the circumstances stated—as the probabilities were the greater, so the occurrence of storm during this season, in the higher latitudes, would be more frequent at the period of the setting in of the positive lunar tide of new, than at that of full moon,—other circumstances being the same. And accordingly,—as I have had occasion to remark long before my inquiries led me to the knowledge of the principle in which it had its source, and which, I entertain no doubt, will always be found borne out by the fact,—as refers to the occurrence of storm during this season in the *higher,* in ordinary,—and in the *middle* latitudes of our hemisphere, during *severe winters,* i. e. when the tendency of electric action as connected with the

annual circle is to *drought:*—the proportion in reference to the occurrence of storm at the period of the setting in of the positive tide of *new*, as compared with that of *full moon* is, as, or about, *three* to *one*. Whether, however, within the same parallels, such be the case on the shores of North America,—and that this the greater degree of contrast in the lunar action with us at the setting in of the positive tide of new, than of full moon, has, or has not, its source in the division of electric action in the atmosphere subsisting between the eastern and western hemispheres, as noticed,—I cannot take on me to say; as nothing short of actual observation carried on simultaneously in America and in Europe can be expected satisfactorily to decide whether such be the case or not. But to resume:—In referring our principles to the test of facts,—as, if well founded, that the phenomena of every succeeding year will bear ample testimony of their correctness; and consequently, that it were unnecessary, in this place, to multiply instances from the past; I shall content myself with the following memorable one, as being fully in point in reference to this class of tempests. The shores of the Baltic during this the winter progression quarter,—from their greater proximity to the pole than the countries lying further south, being, more immediately than the latter, comprehended within the portion of the hemisphere where the tendency of electric action

as refers to the annual circle is to *drought*;—are those consequently, which, perhaps, more than any other, should afford the most frequent and certain illustrations of our theory, if correct: insomuch that when storm during this season occurred in the Baltic, it should be about the periods of the setting in of the positive lunar tides of new or full moon; but, for the reasons stated, more particularly at the former periods. And accordingly, without dwelling on other instances of more recent date, by referring to the almanac of 1824, we shall find that the hurricane which occurred in the Baltic on the 19th of November of that year, and which, by the irruption of the sea it occasioned, laid, during the space of several hours, the city of Petersburg under water, occurred precisely at the period indicated by our principles:—the 19th of November, 1824, having been the *fifth* day after the period of the second quadrature of the moon, and consequently the *first* day of the positive lunar tide of *new moon* by which it was succeeded.

However, in turning to the southern limb of our hemisphere, or the entire of that portion of it where the tendency of electric action in the atmosphere during the winter progression season, as refers to the annual circle is to *rain;* we shall find that with this the difference in the *tendency* of electric action in the atmosphere, all the other circumstances connected with the occurrence of storm, as refers to the

lunar circle, are opposite, or contrasted with those of its occurrence, as stated, in the northern limb, where the tendency is to drought. For, as the periods of the *accords* in the lunar circle, with the existing tendency of electric action in the atmosphere in the annual, are, as stated, towards the *conclusion* of the lunar tides; and further, that a greater tendency to rain, as stated, subsists during the half of the lunar circle which extends from the setting in of the positive lunar tide of *full moon*, to the conclusion of the negative tide of the *second quadrature* by which it is succeeded, than during its opposite division, or from the commencement of the positive tide of new moon, to the termination of the negative lunar tide of the *first quadrature*, by which it is succeeded. Thus it follows that, in the *lower* latitudes in ordinary seasons, and in the middle and even higher latitudes during very *mild* winters, the order of occurrence of storm in the lunar circle, is *towards the conclusion* of the positive lunar tides; but, for the reason stated, more particularly towards the conclusion of the positive lunar tide of *full moon*. And, as in the former case, by referring these principles to facts, the meteoric chart of the annual circle in the preceding article will show, that the chief *storm crisis* of its winter progression quarter occurred in our skies on the [illegible]th of November, being the *second day* after the l moon, or going out of its positive tide.

The extraordinary mildness of the winter of 1833, having caused that the tendency of electric or meteoric action in the atmosphere in the annual circle throughout the season, was, in our latitudes, equally as in those further south—to *rain.* Thus it will follow that, as in the higher latitudes where the tendency in the annual circle during this the winter progression quarter, is to *drought,*—as the intervals of storm and bad weather occur at the *setting in,* so those of fair weather occur towards the *conclusion* of the positive lunar tides, and usually continue with the fall of temperature during the succeeding negative tides. Whereas, throughout the opposite division of the hemisphere where the tendency is to *rain;*—as the bad weather falls towards the conclusion of the positive lunar tides, and usually continues during the following negative tides,—the order of occurrence of *fair* weather in these latitudes, during the winter progression quarter, is at the *commencement* of the positive lunar tides;—these being the periods during which, as stated, the *exceptions* to the existing tendency in the annual circle should occur.

Now, assuming these our principles in reference to the occurrence of storm during this the chief storm season of the year, as regards the opposite divisions of our hemisphere, to be substantially correct: in order, by a single instance, to point out their importance;—let us suppose them to have

been published, and *accredited*, previous to the late destructive winter of 1833 :—how much, it may be asked, of the 100,000 tons of shipping lost by storm, as reported in the newspapers, during this short period, as of the enormous sums in the shape of *insurance* paid on these losses, might not have been saved to the English mercantile world,—simply by *a foreknowledge* of the periods of occurrence of the tempests by which these losses were induced; which, under such circumstances, their publication would have supplied to the parties interested:—not to speak of the waste of human life incident to these wrecks, which had thus been prevented? This will serve to show that if, as stated by the writer of an article in a late number of the Edinburgh Review, " astronomy has been regarded in all ages as the *first* in importance of the physical sciences," owing " to a dim perception of its connexion with some of the most important interests of mankind;" —it was not without reason that even while thus involved in shade, and consequently while debarred from a knowledge of the extent of this connexion, such a conviction, as if by intuition, should have always prevailed. And yet when, in 1831, the author proposed to publish this work in London by *subscription,* he was unable to obtain, as alluded to in a preceding article, so much as twenty subscribers to second his intention! But to resume.

As there are many shades of colour between per-

fect white, and black;—so, whether as connected with the different stages of this the winter progression quarter, or with the different parallels at the same period of the season,—there will always exist a variety of shades in reference to the prevalent tendency of electric action in the atmosphere in the annual circle, between total or perfect drought, and the *general tendency* to drought in the northern division of our hemisphere: as in its opposite or southern limb, between incessant rain and the general tendency to rain. And consequently, though in those regions in either division of the hemisphere where the tendency in the annual circle is decidedly either to drought or rain, that, similar to the instances cited, the occurrence of storm during this season will be found to quadrate exactly with the period of the lunar action when, according to the order of its occurrence as stated, it should occur.—Yet, in the intermediate regions where the tendency to either species of electric action in the atmosphere is less decided, whether owing to the circumstance of latitude or the nature of the localities, the same exactitude in the occurrence of storm in reference to the lunar action, as in the instances referred to, cannot be expected. And thence, in reference to the northern division of the hemisphere where the tendency to drought is not so decided as further north;—the storms which in the latter regions will occur on the *first* day of the

positive lunar tides, may not occur in proximate regions further south, where the tendency to drought is not quite so decided, till the following or *second* day; and finally, still further south, not before the *third*, or usual period of the lunar *syzygies*. While, on the extreme limit of the opposite or rainy division of the hemisphere lying next the line of demarcation which separates it from the northern, the chief storm crisis of the positive lunar tides may fall on the *first* day after the period of the syzygy; still, further south, where the tendency to rain is more decided, such crisis, as in our skies on the 29th November, 1833, as stated, may not occur till the *second* day after the syzygy; and finally still nearer the tropic such storm crises may not occur till the third or last day of the positive lunar tide. However, it will readily appear that the chief periods of these variations must be during the early stages of the winter progression quarter; as, that the chief theatre of their occurrence will be, for the most part, confined to the central latitudes of our hemisphere.

It may be further observed that in *insular* situations, such as England and Ireland, where, owing to the copious radiation of heat which takes place from the waters of the ocean as we approach the period of the winter solstice, an *artificial state* of atmospheric temperature, as contrasted with proximate regions more open or exposed to the effect of

the dominant action in the annual circle, is induced; and where, in consequence, while the preponderance in the temperature in regions more distant from the sea is to cold,—this preponderance is rather to the opposite, or to *heat*. It will not surprise, under these peculiar circumstances, if, as we approach the period of the winter solstice, or about the beginning of December, the order of occurrence of storm in the lunar circle should be occasionally *reversed;* and that, as is really the case, some of the most violent gales on the southern coasts of these islands, about the period indicated, instead of occurring at the commencement of the positive, occur, on the contrary, at the setting in of the opposite or *negative* lunar tides. Such being the powerful influence on the temperature and other phenomena of the atmosphere exercised at times by *local* causes.

There are some other circumstances connected with the phenomena of storm, during the winter progression quarter, which it may be well to notice in this place, viz. the *impetus* or force of storm during this period, other circumstances being the same, gradually increases with the advance of the season;—being evidently an effect of the increase of force in the existing dominant action in the annual circle at the time, (combined with the circumstance of *accumulation* in this species of meteor, up to the period of the chief storm crisis in the

latter end of November, or in December,) and of the consequent increase of *contrast* subsisting between it and its opposite, the solar action: thus showing, with the instance above cited, the intimate connexion of storm with the principles which either influence, or preside over, the temperature of the atmosphere. A circumstance, however, not a little curious is, that it is not precisely in the *vicinity* of the main focus of the dominant or negative action of the earth in the higher latitudes,—where, during this season, its effect is most powerfully developed on the temperature,—that it exerts its chief influence on the phenomenon of storm; but in the *opposite* or southern portion of the hemisphere. As if, similar to the force of the surge on the sea-shore, that from its action being *horizontal,* its effects are more powerful along this the extreme limit of its range, than nearer the line on which the movement commences. Thus it happens, during the early stages of the winter progression quarter, with the storms which occur in the Baltic and Black Sea; and still later in the season with those which occur in the Mediterranean, and along the shores of these islands, and of the Atlantic, still further south; which, together with being more frequent, are in general more violent than those which, during these periods, occur in the higher latitudes, where the contrary might be expected;—the chief weight of the movement in which these storms have their source, though origin-

ating, as noticed, further north, appearing to accumulate as it progresses south; and thus to fall with increased force on the lower latitudes, or extreme limit to which it extends. Such being the case in the Mediterranean and other seas lying south of us during ordinary and severe, as in our latitudes during *unusually mild* winters, i. e. when the temperature with us, approximates to its ordinary range, during winter, in the southern latitudes of our hemisphere. A sufficient illustration of this was furnished us in the unusually mild winter of 1833, which, for the number and violence of the storms on our coasts was unequalled during many preceding years.

It is further observable, that the *duration* of storm in winter is, in general, proportioned to the *degree of contrast* at the time which, in the region of its occurrence, subsists between the action of the opposite primary forces in the annual circle; the greater being the amount of the contrast and consequent domination of the negative action of the earth over its opposite the solar action in such region, at the period of the occurrence of storm, *the shorter being its duration;* and *vice versâ.* On which account it is,—when storms occur in the north seas during winter,—that, though generally very violent while they last, they are seldom of long duration; whereas in the opposite division of the hemisphere, or lower latitudes, storms during winter are not only more

frequent, but generally of longer duration when they set in. The differences here noticed are entirely referable to the difference which in these opposite regions, and, indeed, along the various parallels of our hemisphere during winter, subsists in the relative force of the *equilibrium* of electric action in the atmosphere; which latter being always in an exact ratio with the amount of *contrast*, or domination of the existing negative action of the earth over its opposite the solar, as noticed; and which, from its being necessarily greater in the vicinity of its main focus, or higher latitudes, than at distances more considerable than the latter.

Thus though, in the first instance, the equilibrium of electric action in the higher latitudes, during winter, requires the presence of a more powerful *opposing force* to overthrow it, than in regions further south, where this its force is less decided; it, at the same time,—similar to a spring, returns more rapidly to its previous position the more powerful it is: and *vice versâ*. And, as that tranquil state of the atmosphere which constitutes fair weather, both in winter and summer, depends on the equilibrium of electric action in the region where it subsists, being, for the time, undisturbed therein;—and, as being a consequence of the latter, [illegible] the violent class of atmospheric phenomena [illegible] source, in the overthrow of this the equili[illegible]tric action, and only continues till it is

again restored. Thus it is—as the force of the equilibrium of electric action in the atmosphere, always depends on that of the existing dominant action in the annual circle at the time,—that storm is, as stated, less frequent in the higher latitudes in winter, as in the lower in summer, than during either season in the opposite regions of the hemisphere; and that, when they do occur, their duration is more restricted than in the latter.—The variations in reference to the continuance of fair, as of changeable weather, being thus, it will be observed, throughout the year, dependent on the variations in the relative degrees of force in the equilibrium of electric action, subsisting in the various regions of the atmosphere.

But to resume:—one of the surest tests of principles, is that of trying or comparing them under *opposite* circumstances; and this may be done by reversing the meteoric chart of the annual circle, and substituting *the summer*, for the winter progression quarter. Thus, besides the observations already made on the former, there are some others which I thought might be more appropriately introduced in this place. The tendency of electric action in the atmosphere during the latter part of the summer progression quarter, being, as observed in a former paragraph, to rain;—and that, considering the season, the *gales*, which at times accompany these rains, are not a little remarkable;—and as refers to to the *periods* of their occurrence, that it is

more particularly by the *remarkable* class of atmospheric phenomena, the nature of the lunar influence on the weather throughout the year should be judged of.—With the change in the dominant action in the annual circle in summer—from *negative* to *positive,*—the order of occurrence of rain in the *lunar,* changes from the positive to the *negative* tides: and thence, instead of the chief period of rain in the lunar circle falling, as in winter, on the positive tide of full moon, it, on the contrary, necessarily falls on the succeeding *negative* tide, i. e. the negative tide of the *second quadrature.* And, as a further consequence, from the *tendency* of the weather towards the conclusion of the summer progression quarter with us, being *to rain,* the most violent gales connected with these rains should thence, according to our principles, occur, not towards the conclusion of the positive tide of full moon, as in the lower latitudes in winter, but towards the conclusion of this the negative tide of the *second quadrature.*—Though already noticed elsewhere, that recurring to these phenomena under the present point of view, is not uncalled for;—by referring to the latter, or rainy part of this the summer progression quarter of 1833, we shall perceive, as marked in the chart, that its chief storm crisis, or, more properly speaking, the first break in the weather at the setting-in of these the periodical rains, occurred in our skies on the 22nd and 25th of May, in the thunder-storms near Liverpool, in the Channel, and in

the south of Scotland, as noticed in the description of the chart. But it was not before Sunday, the 2nd of June,—being the period of *full moon*, that the first of these rains set in with us in Ireland; and then not in thunder-storms, but in very mild rains, unaccompanied by wind: (thus showing how much more powerful the influence exercised by inland seas is, as refers to originating the violent class of atmospheric phenomena whether, in summer or winter, than even the shores of the ocean.)—These slight rains having continued at intervals during a few days, the weather cleared; but, as I had expected, only temporarily: for, on the morning of the 11th June, (the period of the *second quadrature* of the moon having occurred on the 10th,) the rain set in at an early hour, and shortly after came down in torrents, accompanied with a violent gale from the north. Both the wind and rain continued thus unabated till noon, when there was a change of wind to north-west, and the rain ceased. And, as marking the violence of this gale at Dublin, an American ship was stranded by it between Howth and the Dublin lighthouse. This, however, was but the smallest in the list of disasters of this kind on our coasts occasioned by these gales; as on the following day, the 12th of June, they caused the destruction of *ten* ships at Black Pool: and two days after, or 14th, being the *octant* or period of the final going out of this negative lunar tide, there occurred at

and in the vicinity of London, a hurricane, so violent, that the mischief occasioned by it was, as stated in the newspapers, incalculable,—stripping the orchards in Kent of their fruit; and tearing up many of the trees by the roots, &c. These gales, it will be remarked, thus commencing on the Irish coast on the 11th, and having their termination with that of the negative lunar tide of the second quadrature the third day after, on the coast of Kent; and with their continuance and change of position, gradually increasing in their violence—having taken a direction from north-west to south-east in their development;—being nearly *at right angles with their direction* from south-west.—And thus, as the setting-in of *la lune rousse* in April brings with it the north-east wind as a *periodical;* so, it would appear, preceding dry and warm summers,—that the moon by which the latter is succeeded, and which commences in May; usually brings with it the commencement of these periodical rains in our skies;—as the thunder-storm of the 22nd of May, being the first of those which, as stated, marked the setting-in of these rains in 1833, occurred on the third day after the period of *new moon;* or last of its positive tide. And further, that, in the instance cited, when these rains set in about the period of new moon in May, as the *tendency* of the weather at this period of the lunar circle is to *drought,*—they may be expected to be

heaviest, and accompanied with their most violent accessory phenomena at *the close* of its final *negative tide*,* as in the order of their occurrence, according to our principles, should be the case.

Thus, to conclude our observations on the lunar circle, by referring to the quarterly storm crisis of the annual circle, as marked on the meteoric chart,—those connected with its opposite *progression* seasons, will

* From this view of the meteoric distribution of the *lunar circle*, it will be seen, though relatively *a dwarf*, that, similar to those more gigantic ones developed by the action of each of the superior and inferior planets on our seasons,—its *arbre meteoric*, as connected with our atmosphere, bears, as stated elsewhere, a strict analogy and resemblance to each of the parent plants distributed over the opposite hemispheres of the earth in winter and summer, as described. It is further observable of this the lunar meteoric tree, that its phenomena usually *commence and terminate with itself*. Thus literally verifying the words of the Royal Psalmist, that God "appointed the moon for seasons:" as each lunar circle constitutes, in the strictest sense of the word, a *miniature* season in itself. For, though blendings of the same atmospheric phenomena between the positive and negative tides of *the same circle*, and contrariwise, are common; any blending between the phenomena of the lunar tide of the *second quadrature*, and those of the positive tide of *new moon*, by which it is succeeded, very rarely occurs: and if at all, only during the equinoctial phenomena in spring or autumn. This causes, that though, as is sometimes the case in summer—*storm* may mark the conclusion of the negative tide of the *second quadrature;* it will not be found to extend beyond the *fourth*, or, at the utmost, the *fifth* day which succeeds the latter, or intercalary period by which the second quadrature is succeeded; and that when the latter is the case, a change to fair weather may then with confidence be expected. Such not being at all so frequent between the termination of the lunar tide of the first quadrature, and the positive tide of *full moon* by which it is succeeded.

be observed to quadrate exactly with our principles, in reference to the parts of the lunar circle at which they should occur. And as to the other, or chief storm crisis connected with the equinoxes: as the equinoctial phenomena have their source in principles, altogether dissimilar from this class of phenomena, during the opposite progression quarters by which they are succeeded; so, it would appear, that the periods of the chief storm crises connected with the equinoxes, instead of, as in the former cases, occurring either at the setting-in, or at the going-out of the positive or negative lunar tides,—they, on the contrary, as noticed elsewhere, usually occur about the periods of the *syzygies*,—the chief gales connected with the equinox in spring, usually occurring about the period of *new moon:* and in autumn, on the contrary, about the period of *full moon;*—they thus, in reference to the lunar tides appearing to hold a *middle place*, as contrasted with the storm crises of the progression quarters. And it being, as remarked in a preceding paragraph, always by the more *remarkable* or violent development of storm, whether at the equinoxes, or at the other periods of the year, rather than when the contrary is the case, that the lunar influence in reference to this class of phenomena should be judged of. Thus, the equinoctial phenomena in the spring of 1834, owing, possibly, to the great mildness of the preceding winter, had but a very imperfect develop-

ment. Whereas, in the spring of 1831,—the preceding winter having been much more severe than in the latter case, and when the equinoctial phenomena, as stated in a preceding paragraph, were most powerfully developed in the weather,—the chief storm crisis of the vernal equinox of that year, on the 13th of March, occurred on the eve of *new moon.*—On the contrary, however, not only did the chief storm crisis of the autumnal equinox of 1833, as stated, occur at the period of *full moon,* on the 30th of August: but the tremendous gale of the *melancholy* 8th of October, 1832, (as it was emphatically called by the people of Liverpool, from the destruction of shipping which it occasioned in the vicinity of that sea-port,)—being the chief storm crisis of the autumnal equinox of that year; occurred, as will be seen by reference to the almanac, on the eve of *full moon.* To which instances, in proof of this difference in the order of occurrence of the chief gales connected with the equinox in spring and autumn, in reference to the lunar circle, others might be added if necessary:—these the chief periods of storm during these opposite seasons of the year, occasionally occurring a day or two before or after *new,* or *full moon;* but almost always in the order stated.—And, as being at once illustrative of the necessity felt by the people of Liverpool on the occasion of the storm of the 8th of October, 1832, for some means other than those supplied by science

at the time, to assist in ascertaining, in advance, the nature of the approaching changes of the weather, as of the humanity which suggested the measure,—should be noticed the resolution come to by the Dock Committee there, of "having barometers placed in a conspicuous part of each dock-master's office, so that masters of ships might at any time see from the outside the state of the weather, and be apprized of any unexpected change indicated by a sudden fall in the mercury."—And I shall indulge the hope that my humble labours in this department of science may, in some degree, prove effective, in supplying to nautical men, this so necessary and much desired information. The circumstance, however, of the change which, as stated, takes place in the period of occurrence of the chief storm crises connected with the vernal and autumnal equinox, as connected with the lunar circle—(similar to the half-yearly change of *direction* in the *trade winds*, with the earth's change of position in the ecliptic,—and with which latter it would appear to be connected,) is not a little curious; and both demands and merits further observation.

And here,—as having concluded both the general outline and details of our theory of meteorology, as connected with the annual and lunar circles,—the present article would close;—were it not that a paper by M. Arago, referred to in Nos. 82 and 84 of the London *Penny Magazine,* "on the connexion

of the moon with the state of the weather," both from its identity as to subject, with that of the present article, coupled with the respectability of the party whose name it bears, appear to demand, on my part, that some notice should be taken of it in this place.—Indeed, I had taken the trouble to prepare an article of some length, including *lunar tables of the weather* for the years 1827 and 1829, arranged from a journal of the weather kept by me during these years, in reference to this paper of M. Arago: but wishing to reduce the size of the present volume to the least possible dimensions consistent with justice to the subjects treated of; and as a consequence of the latter rather to disengage from its pages every thing savouring of redundancy, than to add to its bulk; I have thought it best to confine my observations on this paper of M. Arago, strictly as connected with the subject of which it treats;—and shall, therefore, in the first place, observe, after the best consideration it was in my power to give it,—that this paper, if it proves any thing, it is, I think, the utter impossibility which existed of ever being able to advance our knowledge in reference to the nature or extent of the meteorological influence of the moon on the atmosphere and weather, by means of *observation, unaided by correct principles*.—Thus, by referring to the report of this paper of M. Arago, as it appears in Nos. 82 and 84 of the Penny Magazine, we shall find that,

as relates to *observation,* we are treated, first, with the tables and results of observations made by M. Schübler, at Munich, Stuttgard, and Augsburg, during twenty-eight different years; secondly, with the results of observations made by M. Pilgram, at Vienna, during twenty-five years, from 1763 to 1787; thirdly, with some observations made in 1774, at Montpellier:—then come the barometric observations made by M. Flaugergues, at Viviers, from 1808 to 1828; succeeded by a long series of observations made at Padua, by the Marquis Poleni; and those made by M. Bouvard, at Paris;—next, by observations made during a *single* year at Santa Fé de Bogota;—those by M. Toaldo, at Padua, continued through nearly half a century;—and, finally, those of Dr. Horsley, during two years—1774 and 1775.—From this it will be seen, that, so far as observation could be supposed to have any thing to do in deciding the question of the lunar action on the weather, there has been no lack of it on the present occasion. And what, think you, gentle reader, have been the results to meteorology, whether in discovery or otherwise, of all these observations? Why simply, that it has been ascertained that at Munich, at Stuttgard, and at Augsbourg, there are more rainy days in the second quarter of the moon than in any other, and fewer in the fourth!—And, further, the admission, "that the average state of the weather, as well as the barometer for different times

of the lunar month, exhibits variations which cannot be accounted for as the effect of accident, or errors of observation:"—but, as a winding up, we have the final conclusion come to by M. Arago, viz. "that the connexion of the phases of the moon with the changes of the weather is, if any, of so trivial a nature, that twenty-five years of observation are not sufficient to detect and separate the effect of the moon from that of other causes." And thus, it must be presumed, the question is set at rest: for who, after such an authority, would be hardy enough even to doubt this decision? And, if for twenty-five years of observations, were substituted 250, pursued without further aids,—it may with some confidence be assumed, that the results would not be a whit more conclusive or satisfactory in reference to the solution of this question. It will, however, appear as rather singular—taking into account the high scientific reputation of M. Arago, and probably of some others of those whose names appear in the above list of *observers*, that, notwithstanding the admissions made in reference to the existence of a lunar influence on the weather, it only appears to be judged of as connected with the occurrence or non-occurrence of *rain*. For if such a thing as a lunar agency on the weather exists, as seems to be fully admitted by all parties,—it will readily appear, that it cannot be *a partial agency*; but that, as assumed by our theory, it must be

connected with the principle of its temperature, equally, as with the other phenomena of the atmosphere. This may serve as a specimen of the inconsistencies into which pre-possessions in favour of particular theories in investigations of this kind, will sometimes lead even the most enlightened men. And, that the supposition of M. Arago having in this instance prejudged the question as to the connexion of the phases of the moon with the changes of the weather, is not hazarded on slight grounds;—the following passages, extracted from *a previous paper* by him, on the comet of 1832, as I found it in some of the journals of that year, will, it is hoped, sufficiently show.* Thus, in section 10 of this paper, in which he puts the question—"will this comet have any serious effect on the seasons of 1833?" "This query," he adds, "will, no doubt, awaken the recollection of the grand comet of 1811, which year was so renowned for its vintage, that wines made in 1811, were called "comet wines." I know that there are strong prejudices against me, but I will say, that neither the comet of 1811, nor any other comet, has ever had the slightest effect on our seasons. I will begin with facts:—comets, people tell us, warm our globe by their presence? Do they? —Nothing is more easy than to refer to the ther-

* In further proof of this assumption,—see the article "*sur la Lune Rousse*, by M. Arago, as published in the Paris *Annuaire*, for (I think) 1828.

mometers kept in the different observatories of Europe. Let us take that of Paris, and we shall find the fact, that the medium temperature of the years most noted for comets, is less than those of the years in which no comets have appeared." (A table is here given, which establishes this fact.) The year 1805, with its two comets, that of 1808, with its many comets, and 1829, in which a comet appeared, are entered in the list of cold years:—and the year 1831, in which there was no comet, is contrasted with the year 1819, when there were three comets, one of which was very brilliant,—as having enjoyed a much higher temperature than the latter. "With these facts before us," proceeds M. Arago, "we cannot attribute to comets any calorific power, as far as our seasons are concerned. But there are other considerations, which we must keep in view. A comet, in passing, can act on the earth in *only* three manners.—1. By means of attraction;—2. By its luminous and calorific rays, which emanate from it in all directions;—or, 3. By the gaseous matter which composes its nebulosity or its tail, and which might fall on our terrestrial atmosphere."—In regard to which, we may be allowed to demand of M. Arago, in his own way,—are these the only manners in which comets in passing can act on the earth or affect our seasons? For, as refers to the most powerful, if not the *only* way in which comets can affect the latter, viz. by their *reflective action*,—

whether positive or negative,—we find no mention whatever in this list; and consequently, so far as M. Arago is concerned, we must assume that the question of cometary influence on our seasons remains as before.

Now, to return to our subject,—the analogy between the meteorological influence—real or supposed—of comets and of the moon, is of that intimate kind, that it may be said to amount to an identity; and as such is treated by M. Arago towards the conclusion of this paper on the comet of 1832; whence, in combating the opinion as to the supposed meteorological influence of the *light* of comets he states, that "accurate experiments proved that the *maximum of light* which the comet of 1811 shed upon the earth was not equal to one-tenth of the *light of the moon,* and when concentrated did not produce the slightest effect on the blackened bulb of the most sensitive thermometer." If, I say, this previously recorded opinion of M. Arago in reference to the assumed influence of comets on our seasons, referring as he does in it, to the supposed lunar influence on the temperature, does not amount virtually to a prejudging of the question of the lunar action, agreeably to the conclusion he comes to in this paper, in reference to the latter, nothing, in my opinion, can. And I will add, without taking into account the influence on the temperature and other phenomena of the sea-

sons and weather, exercised, not by the attractive, but *reflective* action on our atmosphere, whether of comets or of the moon; it were impossible for him to come to any other conclusion in reference to either.

Thus, it will be perceived, at the same time that the influence of comets on our seasons,—similar to the phases of the moon on the weather,—may be, and as I feel convinced is, *undoubted;* do we find M. Arago,—simply by trusting to false lights,—not only sceptical in reference to such influence, but absolutely denying its existence. And what he says as to the question of the lunar action on the weather, is so qualified, as virtually amounts to the same:—which,—from the impossibility of making any advances without them, may serve to show of what importance to the cause of science and of truth is that of arriving at a correct knowledge of *first principles.*—" I know," observes M. Arago, " that there are strong prejudices against me, but I will say, that neither the comet of 1811, nor any other comet, has ever had the slightest effect on our seasons. I will begin with facts:"—*Facts*, as the word is here introduced, has an imposing appearance at first sight; but it should be recollected that facts are sometimes *misapplied.* And, that it does not follow, because *the light* of a comet or of the moon produces neither a calorific or frigorific effect on the temperature of the atmosphere, that

the *reflective action* of these bodies—according to the positions they occupy in reference to the sun and earth—may not be productive of either, I hope presently to show:—as, to the want, whether of being *aware* of the fact, or of making such a distinction, it is,—to which is fairly to be ascribed the whole of the errors fallen into by M. Arago on the subject of the influence of comets on the seasons, as of the lunar action on the weather. And in order to show that this is the radical error of M. Arago,—as the analogy between the action of the moon on the atmosphere, and that of comets, if it exists, appears to be admitted by him;—the facts I shall refer to for the purpose of proving my assumption in reference to the influence of their reflective action, are such as are connected with the lunar phases. And further, as being still more illustrative of the correctness of the fundamental principle of our theory of planetary temperature,—the proofs I shall select are such as must be esteemed the least equivocal, from their connexion with that part of the lunar course when *the light* of the moon, as refers to us, is *totally extinct*, viz. the period of the change or *new moon*. The action of the moon on the temperature of the atmosphere for three days before, and during the succeeding
[illegible] after the period when she passes the
[illegible]position with the earth to the solar
, and at full moon, is, according

to our theory, positive, or *calorific;* and during the intervening periods of the lunar circle negative, or *frigorific.* The lunar action thus raising the temperature with the tides, and lowering it with their fall;—other circumstances being the same. As, however, owing to the operation of causes noticed in the preceding pages, it is only at particular periods of the year that this influence of the moon as refers to the temperature, becomes fully apparent; and that the latter or *rainy* part of the summer progression quarter, and the Michaelmas summer at the opposite period of the year, are those during which this influence on the weather is in general most apparent; the instances I shall cite in proof of its existence are chiefly those connected with the positive tide of the *new moon* which occurs in the month of May, in its usually marked effects in advancing the temperature. And it may be well to state that the reason why this positive lunar tide is so much more remarkable than those by which it is either preceded or followed, for this its calorific effect on the temperature,—appears to be, that it occurs at the period of the change of *tendency* in the annual circle from drought to rain, which, preceding dry and warm summers, occurs in May; and consequently, when the *currents* of the atmosphere are for the most part suspended; which, together with the lunar action being better sustained in the annual circle at this than at other periods of

the year, thus, with all the truth and regularity of the most perfect mechanism, fully develops its powerful influence on the temperature and weather. The first of these instances I shall notice occurred in London in the spring of 1831, where I happened to be at the time, viz. on the 12th of May, (being the period of *new moon*), and subsequent days, when a rise of temperature took place such as to have been generally noticed in the journals. It was the more remarkable as, subsequent to the *second quadrature* of the moon, immediately before, the cold was such that, on the morning of the 7th of May, *ice* half an inch thick was formed in some places near London. The second instance alluded to occurred at and subsequent to the period of *new moon* on the 19th of May 1833, when the temperature at Liverpool, and in other parts of England, rose to 74 deg. of Fahrenheit in the shade. And though last not least, the remarkable rise of temperature which in May this year (1834) attended the period of new moon, an idea of which will be best conveyed by the following article copied from the London *Courier* of the 12th of May, 1834:—"For several days the weather has been extremely sultry. On Thursday" (8th of May, and period of *new moon,*) "afternoon at half-past two o'clock, M. Chevalier's thermometer marked $20\frac{2}{10}$ deg. above Zero, Reaumur, or $77\frac{1}{2}$ deg. Fahrenheit; yesterday" (Friday the 9th of May) "at noon, $23\frac{8}{10}$deg.

R., or 85¼ deg. F.; at one o'clock, 23$\frac{1}{16}$ deg. R., or 84¼ deg. F.—*Paris Paper.*" With facts such as these before us, not resting on so questionable a principle as that of the *reflected light of the moon,* but on something much more real and substantial, i. e. the presence of her *mass* at a particular point of her orbit;—and not depending on a particular instance, but on consecutive instances derived from the phenomena of different years,—not to notice the other evidences of a similar kind to be found in the preceding pages,—the public will decide between M. Arago and me, as to which of our views, in reference to the meteorological influence of the moon, is the most conformable to reason and to fact, and consequently the most worthy of credit; viz. the view taken by our theory in assuming the existence of a general and uninterrupted lunar influence whether on the temperature or other phenomena of the atmosphere; or that of the partial and nearly imperceptible lunar influence on the weather assumed by M. Arago? For, returning to our proofs,—it will immediately strike any unprejudiced person that, whether from the different periods of the month of May at which in each of these different years the remarkable rises of temperature noticed occurred, or the coincidence between each, and the period of *new moon,*—that there was nothing *accidental* in them;—but that, as assumed, they had their source in the influence exer-

cised by the positive action of the moon in each instance, at the period of the change, in inducing such an effect on the temperature. It was due to the cause of truth that the proofs in reference to the true theory of astronomy,—and of which the department connected with planetary temperature,—the lunar action on the weather, &c., forms so important a part,—should be of that striking, self-evident, and unequivocal kind, as that nothing in the shape of doubt or uncertainty could fairly attach to them; and such I esteem those connected with our theory.

It will thus, probably, excite the surprise of M. Arago and of others who have thought with him, that an influence such as that assumed by our theory in reference to the lunar action on the atmosphere, whose very existence they affect not to conceal their doubts of—should, when rightly understood, be found to sustain so important a part in reference to the phenomena of the atmosphere, as that, without exaggeration, it may be denominated *la roue balancière*, or balance-wheel, which, throughout the year, regulates, and, in great part, determines the changes of the weather. For, as the changes which take place in the *tendency* of the weather in the annual circle, whether to drought or rain, are, as stated in a preceding article, confined to [illegible] and in some latitudes and localities, [illegible] throughout the year;—and that,

except about the equinoxes, the changes in the diurnal circle, of themselves, would not be sufficient to induce changes in the weather; thus, a tolerable estimate may be formed of all that is effected by the lunar action; as without it the changes of the weather, incident to the progression of the seasons, as in the higher and lower latitudes, would be so abrupt,—and when set in, would be so unchangeable, that all the charms incident to variable skies would be nearly extinguished; but which, as they exist—similar to the almost imperceptible gradations in the *nuances* of light and shade observable in the works of a Corregio or a Poussin,—at the same time that they announce the *master-hand,* constitute one of the chief perfections of their compositions. Thus, I say, it is, in reference to the lunar action on the weather—particularly in the temperate latitudes,—that we are chiefly to ascribe that endless variety in the gradations of light and shade, of drought and humidity, to which so much of the coolness and salubrity of our skies, as of the fertility of our fields and beauty of our landscapes is to be ascribed. Further, as being not only relevant to the present subject, but further illustrative of the correctness of our principles, may be noticed the circumstance mentioned by M. Arago in his paper on the comet of 1832 already cited,—as to the temperature of 1831,—though a year in which no comet appeared, having been much higher than that of

1819, when there were no less than three comets. For, as observed in a preceding page, this rise in the temperature of the seasons was anticipated by me previous to the publication of my work in 1830, as may be seen by referring to its pages,—owing to the then position of the superior planets. And every succeeding year since having borne unequivocal testimony thereof, by the consecutive rise that has taken place in the temperature of the seasons, as to the correctness of the principle then assumed by me, it may serve as proof to others, if not to M. Arago, of the existence of this influence; and of the strict analogy which subsists between the action of the whole,—but more particularly of the external or superior planets on the temperature of the seasons, and that of the lunar action on the weather. And that, though the presence of comets in the solar system may, according to their position in reference to the earth and sun, be productive either of increased heat or cold on the seasons when they appear,—yet, that to the relative position of the superior planets in this respect it is, as to its true source, to which is chiefly to be ascribed the variations which we have occasion so frequently to notice in the temperature of different years:—and not to the fooleries put forward by some to account for this late improvement in our climate, since 1830, being caused *by the clearing of the forests in Canada*, and United States of America: which, it is hardly necessary to add, the

first severe winter that occurs will be sufficient to disprove, similar to so many other versions of the subject by which it was preceded.

These papers of M. Arago, however, combined with the work lately published by the Rev. W. Whewell, on Astronomy and Physics, of which a notice will be found in the appendix, as in the preceding pages, —I must esteem as not a little valuable under another point of view, as they will serve to show the state of utter darkness, whether as regards the knowledge or application of the true principles of Nature in reference to astronomy and physics,—in which the author found these sciences at the period when he first turned his attention to them. *M. d'Alembert,* in his *Eloge de M. du Marsais*, observes, that "un des plus grands efforts de l'esprit humain, est d'avoir assujetti *les Langues à des regles*." But in admitting this fact, he qualifies it by adding, "Mais cet effort n'a été fait que *peu à peu* ;" from the circumstance that languages being in their origin more the result of necessity than of reason, were formed *without principles ;* and thence the magnitude of the difficulty on the part of philosophers, "*à débrouiller*," as he expresses it, "*ce chaos informe*." He further observes, "Des inventeurs dans les sciences n'ont donné que les résultats de leur travail, sans *montrer l'esprit qui les avoit guidés*. Pour bien saisir cet esprit si précieux à connoître, il faut se remettre sur leurs traces ; mais

c'est ce qui n'appartient qu'à des philosophes comme eux. L'étude et l'usage suffisent pour *apprendre* les regles, et un degré de conception ordinaire pour les appliquer; l'esprit philosophique seul peut remonter jusqu'aux principes sur lesquels les regles sont établies." Elsewhere also this profound reasoner, to whom the cause of science and of truth owes so much, and the whole of whose writings, from their excellence, to use a phrase of his own, "mérite d'être lu, jusqu' à l'*errata*:"—in treating of the vague, inconclusive ideas entertained by the ancients, of the system of the world, observes, "On n'y trouve point *ces détails précis, exacts et profonds*, qui sont la pierre de touche de la vérité d'un système, et que certains auteurs affectent d'en appeller l'appareil, mais qui en sont réellement le corps et la substance; parce qu'ils renferment les preuves les plus subtiles et les plus incontestables, et qui en font par conséquent *la difficulté et le mérite*." If, then, a person such as M. d'Alembert, who, from his own not cheaply acquired knowledge in the walks of science, may be considered a competent authority on such matters, attaches so much importance to the labours connected with changing and new modelling the languages from their originally crude and barbarous state, to one based on harmony and system, as being one of the greatest efforts of the human mind;—and who, further, in reference to labours of this kind, considers the analysis and just

distribution of the parts of the subjects treated of which constitute their *details,* as being at once the touchstone of the truth of the systems thus digested, and that which constitutes both the difficulty and the merit in founding them;—if, I say, the opinion of such a man as d'Alembert merits respect,—by an examination of these the labours of M. Arago and the Rev. W. Whewell, the most distinguished, perhaps, of the modern writers who have treated of the lunar action on the atmosphere, and of astronomical principles in their widest range and application,—and by contrasting their ideas and views on these subjects with those presented by our theory, whether as refers to general outlines, or more minute details,—and keeping in view the continual reference *to facts* by which the assumptions of the latter are everywhere borne out; by, in a word "comparing that picture, with that,"—without incurring, as he hopes, the charge either of foolish egotism or arrogance,—the author may claim some merit in having so far succeeded in an undertaking such as the present; where, *in order to succeed,* every thing had, in the first place, to be changed and new modelled; and both placed and examined on other and totally different principles from those which he found, and which still continue to be attached to them, as the generally received and accredited ones. It is scarcely necessary to add, that, without the *point d'appui* supplied by his discovery of the

analogy between the lunar action on the tides and temperature, and the succour thence continually afforded him in his gradual and tortuous advances towards the perfecting of this theory:—his observations, however long continued, or his industry, however great, had, in reference to such result, proved equally futile and abortive. For, observation in this department of science, as we see, without the ground of support supplied to it by some fundamental principle or principles, to and from which alternately, to revert and extend itself;—or principles, however correct, without the aid of observation to assist in giving to them their necessary development, could never succeed in making such applicable to objects of utility. And consequently, in a case so infinitely intricate and complex as that connected with the sources of movement in the heavenly bodies, and with the forces which preside over the principle of their temperature and other atmospheric phenomena, a combination of both, as in the present instance, became indispensable, in order—at any time—to insure even the chance of success in a work like the present. And yet, such is the discredit into which the desire to account *theoretically* for the phenomena of the atmosphere, as connected with the lunar action, has—owing to the continual want of success attendant thereon—fallen;—that the writer of the articles alluded to in the *Penny Magazine*, under the head "*The Moon*," concludes the last of them

as follows:—"We hope what we have said may help to draw a distinction in the minds of some of our readers between facts established by attentive observation, and the relics of *an absurd system of philosophizing*;"—thus esteeming all such attempts as things utterly futile;—which shows how necessary it is, at times, to be on one's guard against what comes recommended under the imposing exterior of a *received opinion*; or what, with some justice, has been denominated "*la superstition littéraire.*" "L'esprit de *calcul*," observes M. d'Alembert," "qui a chassé l'esprit de *systême*, regne peut-être un *peu trop à son tour*. Car il y a dans chaque siècle *un goût de philosophie dominant*; ce goût entraîne presque toujours quelques préjugés, et la meilleure philosophie est celle qui en a le moins à sa suite." The rage for *system*, or theory, which prevailed at the time of Descartes, of Huyghens, of Leibnitz, and Newton; and which rage for system, the high reputation acquired by Newton, and the consequent belief almost universally entertained as to the correctness of the discoveries made, or supposed to be made by him, tended to bring, in some sort, into disrepute: from the supposition that any further speculation in the departments of physics, touched on by this great philosopher,—(notwithstanding his own recorded opinion, cited elsewhere, to the contrary)—was altogether superfluous.—Thus the spirit of system in philosophy, was succeeded by that of *calculation*;

and this latter, in its turn, has yielded to the ruling taste for *observation.* The discoveries which, since the time of Franklin, have been progressing both in chemistry and electricity, and their supposed relations with the atmosphere and its phenomena, having, very naturally, given rise to the prevailing sentiment in favour of the latter. And this, we see, to the total interdiction of the spirit of theory, or philosophizing, as it is called;—a practical illustration of the efficacy of observation as refers to meteorology, in this its free and *independent* state, being furnished by the result of the labours of M. Schübler and Co. as cited. To this the prevailing sentiment in favour of observation, or more probably to his total disbelief of its existence—as I am to assume,—is to be ascribed the absence of all allusion by M. Arago in his paper *as to the analogy subsisting between the lunar action on the tides and temperature;*—though the written communication on the subject made by me to the French Institute in 1826, was presented by no other than M. Arago; as likewise his omission of all allusion to my astronomical work, founded on this discovery,—though, as in the former case, the copy of it presented by me to the Institute, in 1830, was through the hands of M. Arago; whose very obliging letter on the occasion in his capacity of secretary, is still in my possession. And yet, in this same paper of M. Arago, the observation of M. Toaldo, that " the nails and

hair grow much more quickly when cut during the increase of the moon than when cut during the wane," with others of a similar description, are not esteemed as being either too frivolous, or too much displaced, to merit attention.

M. Arago will recollect the observation, that not only praise and blame, but even *silence*, is, at times, to be suspected; "*car le silence a aussi sa malignité et son injustice.*" Thus, whatever may have induced M. Arago to pass over unnoticed this most important discovery, it is not easy to suppose it could have been caused through *forgetfulness*. And my reason for noticing the circumstance is, that it serves to illustrate the way in which such matters receive the *go-by* from those whose duty it is to attend to them, when not to their taste, or recommended by other considerations than those connected with their real or supposed merits. And, should the information prove satisfactory to M. Arago, I can with truth assure him, that his conduct in this particular has had no lack of humble imitators nearer home. However, without in any way wishing to be understood as justifying conduct of the kind, which goes to close up all access to the public through those scientific bodies, to which they are in the habit of looking up for information:—at a moment of victory in the cause of science and of the interests of humanity such as the present, and of which an Alexander or a Cæsar might feel proud,

—I may well afford to overlook such *bagatelles*, which can only redound to the discredit of the parties themselves.—I have not, on such occasions, forgot the observation that, as observed elsewhere, " l'éloge général et du moment, est presque toujours exclusif de l'éloge à venir ;" and therefore I did not allow any such supposed unworthiness, on the part of others, to interfere with prosecuting, to the utmost of my ability, the object I had in view :—aware that, if successful, a time would arrive when I might rationally expect that more even-handed justice would be accorded me.—I may add, in reference to M. Arago, that few entertain a higher respect for his talents and industry than I do ;—for such are his powers of mind, that he may be said not only to penetrate, but *transfix* the subjects to which he applies himself. But, similar to the opposing principles in mechanics, or the range of the microscope,—what M. Arago gains in this perspicacity of mind, appears to be lost to him in the opposite direction. And thus that the quality which gives him such advantages in points of detail, renders him, in a like degree, unfit to grapple with *ensembles* of the magnitude of those connected with the subject of the lunar action on the weather. Of which, indeed, his paper on the supposed existence of *two* magnetic poles in our northern hemisphere, may be considered as affording a proof :—for, he might with equal justice, suppose the existence of

two centres of gravity in that part of the earth. I may further observe, that in science, as in war, occasions will occur in which the part acted by a Curtius becomes, in some sort, necessary; in order, if possible, to fill up *its chasms*. And that it is not such men as M. Arago, who are the most likely to risk their reputation in such attempts. Or who, in a word,—similar to a Newton, or a Columbus,—will be the first to lead the way, and strike into those bright, though hazardous *deviations from the beaten tracks*, by which alone new worlds, in the unexplored regions of space or of knowledge can be acquired. *Car, " C'est en se permettant les écarts que le génie enfante les choses sublimes!"*

DIURNAL CIRCLE.

HAVING entered so much into detail in treating of the annual and lunar circles of electric action on the atmosphere, the fewer observations will be necessary in reference to the *diurnal circle.* And the first of these, as being, perhaps, the most worthy of notice, is, that the order of occurrence of rain and of fair weather in the diurnal circle,—as alluded to in a preceding article,—is not, as might be supposed, derived from the action of the primary forces in the *annual;* but from their action in the *lunar circle.* Thus showing the important part sustained by the lunar action on the weather: as likewise the relative gradation, and intimate dependance subsisting between the action of the primary forces in these the three local circles of their movement.—The order of occurrence of *fair* weather in the diurnal circle, as stated, is—as between the superior circles—during the *concords* in the action of the primary electrical forces in the diurnal and lunar circles: and of rain and its accessories during the periods of their *contrasts* in the latter; i. e. of fair

weather during the positive lunar tides, the order of occurrence is *by day*, and that of rain, *by night;* and during the negative lunar tides, as this order is reversed, the order of occurrence of fair weather is *by night*, and of rain, *by day*. But owing to the obliquity of electric action on the atmosphere in these circles, as refers to its ultimate results on the weather:—during the positive lunar tides the rain that should occur by night, usually occurs early in the morning, and during the forenoon; and fair weather during the afternoon and beginning of the night: as during the negative lunar tides, rains usually occur in the *afternoon* and beginning of the night; and fair weather during the latter part of the night and forenoon. And notwithstanding that, owing to its relative diminutive proportion, it is so much easier to derange this order in the diurnal, than in the lunar circle; yet, to the attentive observer, it will, perhaps, prove matter of surprise, to see the conformity which exists in reference to this order of the occurrence of fair weather and of rain, throughout the greater part of the year, in the diurnal circle: but more particularly about the periods of the equinoxes, and during the greater part of the opposite progression seasons, when the lunar action on the weather is regular in its effects. And even during the opposite *transition seasons*, when the opposite actions of the moon are seen so frequently blended and confounded in the weather;

still the instances of the intimate dependance subsisting between the diurnal and lunar circles during this season, as marked by the periods of occurrence in the former, of some of the most striking atmospheric phenomena,—will be found neither few nor unimportant. Of these, the following, as being some of the most remarkable, may be taken as a sample,—viz. the hurricane, accompanied with tremendous peals of thunder, which occurred at Paris, on the morning of the 5th August, 1830, which prostrated many trees in the public gardens, and did considerable damage to houses, &c. The period of *full moon* having occurred on the 4th, or day before. A second thunder-storm at Paris, on the morning of the 17th September, the same year; but, though not so violent as the first, which did considerable damage in the vicinity. The same day (as reported in the Paris papers,) a violent storm occurred at the town of Hanover; by which, together with plantations of trees, fourteen houses were said to be destroyed. This the 17th September, 1830, having been the period of *new moon*. To these may be added the destructive hail-storm, which occurred at Constantinople, on the morning of the 5th of October, 1831, being the period of *new moon*, of which the following account appeared in *The Times*, of the 12th November, 1831:—" After an uncommonly sultry night, threatening clouds rose about *six in the morning* in the horizon, to the south and west,

and a noise between thunder and tempest, and yet not to be compared to either, increased every moment." . . . . "Lumps of ice as large as a man's foot falling; first singly, and then like a thick shower of stones, destroyed every thing they came in contact with," &c. The same remarkable coincidence generally occurs in the periods of the hurricanes in the West indies, as I have had occasion more than once to observe, in the accounts of those terrific phenomena published in the papers. And I have likewise had occasion frequently to notice this coincidence during the equinoctial gales;—their most violent action in the diurnal circle, being, according to this the order of their occurrence at the time, in reference to the lunar circle. As further illustrative, it may be noticed that, during the summer progression season, when, as regards the lunar circle, rains occur during the *negative* lunar tides; and, as is usual, continue to a day or two in the succeeding *positive* lunar tides: that during the negative tides the rains fall in the afternoon, as in the order of their occurrence should be the case.—But that, with the commencement of the positive tide, the period of these rains in the diurnal circle, will be observed to change with the change in the lunar action, from the afternoon *to the forenoon,* previous to the taking up of the weather: of which latter, indeed, this change in the period of the occurrence of these

rains, may be considered as an infallible sign. More might be added in this way; but as instances of the more ordinary class of atmospheric phenomena will come under every-day observation, those who wish to pay attention to the subject, in reference to the order of occurrence of rain and fair weather in the diurnal circle, as connected with the lunar; will, it is assumed, have ample opportunities of satisfying themselves as to its correctness.

To conclude this sketch of the local circles of electric action,—annual, lunar, and diurnal,—by reverting to the former. It can hardly fail to strike the attentive observer, that our progression on the annual circle, possesses all the characteristics of *a voyage ;* every part of which, circumstances of locality being the same,—varies, more or less, from the other. Which circle, as contrasted with itself in different years, but more particularly in the temperate zones,—presents, though not to the same extent, a similar diversity in its seasons. Thus showing, as would seem, that there is nothing more repugnant to nature than *sameness ;* and, on the contrary, nothing more agreeable to her than variety. And, as this voyage on the annual circle is one in which all who exist are, necessarily, embarked; and from which, except by death, none can exempt themselves; and further, in which, though differently, all have an interest, more or less considerable :—

If ever problem, more than any other, was calculated to collect the undivided suffrages of mankind to its explication, it must be that which forms the subject of the present work. In which—and for the first time—the whole of this interesting and all-important subject, is found treated of and explained in its various bearings and details.

LOCALITIES.

Having in the preceding parts of the work noticed, partially, the subject of *localities*, as connected with meteorology, the fewer observations will be necessary in this place. And, as infantry, cavalry, and artillery, are denominated the three arms of war;—so the effect on the temperature and weather, exercised by *locality*, is such, that, with the action of the sun and earth in the annual circle, and the lunar action, it may be said, to constitute the *third* grand arm of meteorology. This influence is derived from the original principle of *reflective action*, combined with the law of its *convergence*, as connected with the action of the primary electrical and magnetic forces on the temperature, to particular centres, or points of the reflecting surfaces, where thus it is most powerful. And, as regards the *inverse species* of electric action and rain,—which is more particulary connected with the *middle region* of the atmosphere;—from the influence in originating the latter exercised by mountains, and vicinity of the sea.

The superficies of the earth considered in reference to its reflective action, is divisible into opposite hemispheres, in which the action of the primary forces, owing to the angle formed by its axis, is always reversed: thus constituting the first grand division in its *localities*, as connected with meteorology. The superficies of the earth is again divisible into opposite species of reflectors,—*land* and *water*. And of which, as much of the direct action of the sun and earth on the latter, is *neutralised* in the process of its decomposition, in upholding the principle of *circulation* between these the waters of the earth and its atmosphere;—the water surface of the earth, as contrasted with its land superficies, is but *secondary* in its power as a reflector: thus constituting the second grand division in its localities. And, in these principles, including the peculiar influence exercised by mountains, and vicinity of the sea alluded to, combined with that of *extent*, and the *nature* of the reflecting surface of land, i. e. whether as covered with *forest*, which neutralizes as much, nearly, as water the action of the primary forces on the temperature,—or as in clear and extended plains, whether in sandy deserts, or in cultivation, whose power as reflectors is at the opposite extreme of the scale, being the most powerful;—the whole of the important influence exercised by localities on the temperature and weather, may be said to consist.

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St. Pierre, I think it is, who compares the opposite hemispheres of the earth to two vast mountains based on each other at the equator. And this, as refers to meteorology, is so strictly the case, that we are presented in *miniature* with the same diversity of climate, *vertically,* in ascending the higher mountains of the tropical regions, as on the larger scale *horizontally*, between the lower and higher latitudes,—owing solely to the relative position of the base of these mountains, as contrasted with their summits and higher regions, to the *main plane of reflective action beneath,* or surface of the sea,—as between the base and summits of the larger or hemispheric mountains, in reference to the plane or line traversed by the main focus of the solar action at the Line. And that, on the other hand, owing chiefly to the difference as *reflectors* subsisting between the land and water surface of the earth:—but more particularly in the middle latitudes, and during winter,—the same diversity of climate, though less strongly marked, subsists between islands, and the shores of the ocean, as contrasted with the interior of continents, as between the opposite parallels—circumstances of latitude being the same. And, as in nature, there exists not only a certain relation and correspondence between cause and effect; but, as refers to the latter, between the ensemble and its parts; thus it is, that, partaking of her dimensions, and, as should be the case,—the effects result-

ing from the operation of her principles are, in all cases, more fully expressed and developed, *en grand*, than in miniature. To which circumstance is referable the more marked effects of *reflective action*, as connected with the *larger class of land reflectors*,—such as the continent of North America, and those of Europe and Asia,—on the temperature, than in the *smaller*, or islands; sufficiently proved by the difference in the range of the opposite extremes of annual temperature in the former, as contrasted with the latter class, circumstances of latitude being the same. As likewise the superior meteorological influence, whether on the temperature, or in originating rain, &c., exercised by the higher ranges of mountains, than mountains of smaller size: as in the annual, than in the lunar or diurnal circles of electric action. And thus that, in order to arrive at the knowledge of Nature,—as contracted and partial views do little other than mislead,—she must be contemplated and studied in her collective relations, and on the larger theatres of her operations.

Here, then, it may be observed, (combined with the particular and overwhelming influence on climate and temperature, caused by proximity to either of the opposite main foci, solar or planetary, to which the action of the opposite species of the electrical and magnetic forces in the atmosphere

converge, whether at the equator, or pole of the winter hemisphere; which is such in the immediate sphere of its influence, as to merge and neutralize all secondary or minor causes :—and the further influence on climate, particularly in the middle latitudes, induced by *radiation,* from the waters of the sea, or ocean,—the only radiation from the earth, be it observed, which exercises any influence on the temperature;)—we are presented, in small compass, with the entire of the principles and causes, whence those variations of climate so marked and long observed in certain countries, which could not be accounted for on the score of *latitude,* and designated by different terms, such as *isothermal zones,* &c. &c., have their source. Here, likewise, we find the explanation of that improvement of climate, which in Canada, the United States of America, and in some of the countries of Europe, has followed on the destruction of *forests.* A subject, it may be observed, which has so much occupied the attention of some scientific bodies of late years :—and which, without being able to assign the true cause, has obtained celebrity for *M. Moreau de Jonnès,** from his work on this subject. And here,

* See "Recherches sur les Changemens produits dans l'état physique des Contrées, par la Destruction des Forêts, par *M. Moreau de Jonnès.*" Bruxelles, 1825 : and the *Rapport Verbal,* de M. Fourier, on this work, to the French Institute.

I may confidently add, the explanation of any new circumstance connected with temperature and climate, which may, as in the latter case, arise, to claim the attention of men of science, will with equal certaincty be found.

The variation which takes place in the meteoric action of localities at the equinoxes,—when their influence is nearly extinct,—as contrasted with this their influence at, and for some time after the solstices, when it is greatest,—being already treated of in the preceding pages,—it becomes unnecessary here to dwell on this part of the subject.

To conclude, in reverting to their assumed primary source, *reflective action*, as recognized by our theory;—there is nothing advanced in these pages, or that can be advanced, as connected with astronomical, or meteorological phenomena, which is not reconcilable with, and explicable on this principle. A circumstance, be it observed, altogether peculiar to it, and referable to no other: as such never has been advanced, or could be advanced, on the principle of *universal gravitation*,—the *Vortexes* of *Descartes*, &c., or any other principle which has at any time been connected with these sciences. By this the principle of reflective action alone, it is, that we are, for the first time, led to the point of view, whence solely Nature is always to be found agreeable to, and in conformity with herself; and

never at fault, or in contradiction: and from which, like the extended vista of some Grecian temple,—the finely adjusted proportions in her dispositions, adaptations, and combinations in the physical world, as in lengthened and varied perspective,—will be observed gradually to develop and unfold themselves in all their various harmonies, and endless details.

GENERAL OBSERVATIONS.

The following observations connected with the theory or subjects treated of in the preceding pages, but for which I could not elsewhere find a place, I have thought it right rather than omit—owing to this their connexion—to collect and subjoin in the present article;—and shall only add that, with the exception of those at the commencement, they are entered without any attention to order or relationship, other than this their connexion with the present theory.

1.—The active forces, as the principles of Nature, are *few* in number: but each is as the other in the range of its operation; and all are universal.

2.—In Nature all is *collective* and *necessary:* and, as being a consequence of such a disposition, nothing therein can be said to be other than relatively detached. For, though the mass of the sun be, as it is, separated from those of the planets, by millions of miles,—he—by means of his atmosphere—is equally *present* with the latter, as regards the

physical influence of his forces,—as though he literally constituted with them but a single mass : and so contrariwise, as regards the influence exercised by the active forces of the planets on the sun, and on each other; which circumstance it is that impresses with the stamp of *individuality* a scale of being so enormous as that of the solar system.

3.—In Nature all is *active*:—a consequence of this is, that nothing therein is *passive*, but relatively.

4.—In Nature all is *full*, whether as relates to *space*, *production*, or *occurrence*:—and as in the former, there is no vacuum or interval unappropriated; so, as regards the latter, nothing—as assumed—can properly be said to take place by *accident*.

5.—The fundamental error of the Newtonian theory of astronomy being—as assumed by the present writer—that what he denominated *universal gravitation*, is the *primum mobile* of the heavenly bodies :—and that such error, however real, neither had, or could have had, any influence on the correctness of the calculations founded on this assumption, from the circumstance that, be the *mobile* of nature, as refers to these bodies, what it may,—as its action on their movement has always been, and must—unless a total change in her laws takes place—necessarily, always continue to be, *uniform* in its results; and that, by whatever name called,

the calculations, if right, founded thereon, must have been borne out by the facts to which they referred, as regarded the orbital movement of the sun and planets. In like manner as regards the principles assumed by the present theory in reference to planetary temperature, and the lunar action on the atmosphere;—notwithstanding that such a variety of facts demonstrate that the temperature, and the other phenomena of the atmosphere are *local,* and *chemical effects* in its body, induced by the operation of electrical and magnetic agencies of opposite kinds, having their sources respectively in the sun and planets;—yet whether these assumed agencies be virtually those which induce in our atmosphere these local effects or not:—if calculations in reference to the latter, founded on these principles, are found generally borne out by the facts to which they refer,—inasmuch as regards all purposes of science and utility, the results will be the same:—for, as observed by the poet, "a rose by any other name will smell as sweet." And thus, as regards our theory,—if the species of connexion which should subsist between cause and effect, be found to subsist between its principles and the facts to which they refer; as this is the most essential, so it is the only point to which its author is disposed to attach importance;—allowing to every one a free latitude to set down what part of the phenomena of the atmosphere he

pleases to the action of electricity, or of magnetism,—holding as he does, that though perfectly distinct in nature, the action of these forces in the atmosphere is *indivisible.*—For, whether such assumptions be right or otherwise, this cannot, in any way, militate against the correctness of the principles assumed, as being those which govern these phenomena in their development.

6.—On the principle of *reflective action,* combined with the law of its *convergence* only, it is, that, not alone the mechanism of Nature as refers to the collective agency, whether positive or negative, of the whole of the planets one on the other, as connected with the temperature of their seasons;—of the more contracted range of the action of satellites or of the rings of *Saturn,* on their primary planets; —or finally, of all the local peculiarities of temperature and the weather in summer and winter,—can be accounted for, and rationally explained. For if— as I hold to be the case—in reference to these local peculiarities of climate, that the various inequalities of hill and dale, of mountain and plain, observable in the land superficies of the earth; and still more than in the latter, in the more extended distribution of this surface into land and water superficies,— though only visible in their effects—induce an equal variety in the temperature and weather of the superincumbent atmosphere during the seasons of summer and winter, as *that* exhibited by these

the reflective surfaces beneath. It will, on this showing,—(particularly in our temperate skies, where the action of either primary force—solar or planetary—during winter or summer, is rarely so powerful as to merge either the influence of these local causes, or that of the lunar action on the weather,)—no longer appear matter of surprise if, as during summer so frequently occurs,—hail and thunder storms should range over particular districts, whilst others in their vicinity remain exempt from such visitations;—conformable to the nature of the localities. Thus, for instance,—narrow seas, lakes, and the vicinity of the higher ranges of mountains,—owing to the frequent eddies in the superincumbent atmosphere induced by their unequal powers—as contrasted with the extended superficies of the neighbouring continents, or of the ocean—as *reflectors,* are those during summer, where such storms are most frequent. The relative force or stability of what may be denominated the *equilibrium of temperature,* and of the direct species of electric action in which it has its source, in the atmosphere of such localities during summer and winter, from being thus frequently disturbed and overthrown,—being necessarily much inferior to that of the opposite class of localities noticed. And this causes that, when pressed on or disturbed, either by the extreme concentration of the direct action, whether as connected with the lunar or annual

circle,—or the electrical collisions in the body of the atmosphere incident to the changes of this action in the lunar or diurnal circles,—the class of localities indicated, is *the first,* where, by the overthrow of the equilibrium of electric action in the atmosphere, the opposite or inverse species of this action, with its accessory phenomena of storm, &c. occur:—circumstances of latitude being the same.

7.—So intimate during summer and winter is the connexion between *the opposite classes of lacalities,* i. e. of mountains and seas including lakes, on the one hand, and of extensive plains on the other,—and the temperature and other phenomena of the atmosphere,—that all *peculiarities* in the former, induce *peculiarities*, whether in degree or in the relative periods of the development of the latter: and exactly proportioned one to the other. And thus, the greater the peculiarity in the influence exercised by any particular location,—whether as connected with the temperature, or with the opposite class of atmospheric phenomena,—the greater will be the peculiarity of climate in such locality during these seasons induced thereby;—and *vice versâ.* From this it follows,—notwithstanding the assumed correctness of our theory as regards the order of occurrence of fair weather, and of rain with its accessories,—that, in all localities which exercise any considerable influence on the phenomena of the atmosphere,—*particular observation* will become

necessary, in order the better to ascertain the extent of the peculiarities they induce; in reference to the development of the opposite species of electric or meteoric action in the atmosphere, as connected with the lunar circle, during these seasons. Which peculiarities being ascertained,—as similar causes will continue to produce similar effects,—the last degree of perfection of which the science of meteorology is susceptible, as regards being able to calculate in *advance* the periods of occurrence in the lunar circle, of the most remarkable atmospheric phenomena in every latitude and species of locality during these seasons will thence have been attained. This being, at present, the precise thing wanted, in order to the constructing with accuracy of those *meteoric charts* elsewhere alluded to. And which, if once constructed with the degree of accuracy of which they are susceptive, and thence made available in navigation,—the sum of casualties by sea might be expected annually to decrease, in exactly the same ratio as greater precision could be introduced in the construction of such charts,—combined with the more general and intimate knowledge of meteorological principles by sea-faring men.

8.—By always keeping in view the *share* which the lunar action—according to our principles—may have in the production of the most remarkable rains, and other atmospheric phenomena,—the variation in the effects of the lunar agency on the atmosphere

and weather, at different periods of the year, and under the influence of different circumstances, will become the more familiar to the observer ; and, consequently, the sooner and better understood. And thus, as nearly half the peculiarites of climate and the weather are derived from *locality,* so it may be said, one half the efficacy of our principles, in reference to ascertaining in advance the nature of the approaching seasons and changes of the weather, must necessarily be derived from *personal observation* as connected with them ; thus varying with the degree of judgment used in their appropriation,—the amount of their usefulness.

9.—As in maps,—whether of towns or countries—places lying *contiguous* are generally marked, in order the better to point out their relative positions with the places represented;—so in elementary works such as the present, it becomes almost impossible to avoid *repetitions;* which, as in the former case, are frequently necessary, in order to show the different relations which, under different circumstances, the same thing may have with others. It may not be amiss to add, that I consider this remark the more called for, in consequence of some severe strictures on my former astronomical work in reference to such repetitions, which appeared in one of the numbers of the London *New Monthly Magazine* of 1830.

10.—In the absence of correct data, things the

most susceptible of demonstration are often looked on, and treated, as doubtful; while things which have no existence save in the minds of those with whom they originate, are at times set down as matters of certainty. Thus, as regards the heavenly bodies,—it has long been esteemed, and continues to be a matter of doubt, whether or not the moon, and some others of these bodies, are invested, as the earth, with atmospheres. This doubt, however, will disappear the moment the phenomena of light and heat, whether in the sun or planets, are admitted to be *local,* as recognized by our theory. For, the locality of these phenomena being admitted;—(and the more the subject is examined and considered, the less doubts, I feel, will be entertained as to its correctness;)—we are enabled, with certainty to conclude, that where, as in the moon, there is *light* in these bodies,—*there* likewise there must be *heat,*—they being conjoint results of the same action;—and that where both subsist there must necessarily be an *atmosphere:* as, without the presence of a local atmosphere the action in which planetary light and heat have their source, could not for a moment subsist. And thus, by this simple but conclusive mode of reasoning, we are led to a knowledge of the fact, that not alone several, but the *whole* of the planets—primary and secondary—are invested with atmospheres the same as the earth.

11.—It is the difference, or amount of *contrast* subsisting between the action of the primary forces in the annual and lunar circles, which determines the amount of the electrical collisions in the body of the atmosphere induced by the lunar changes: and the effects on the weather induced by the lunar changes keep even pace with the force of the electrical collisions in which they have their source. And thence it is, that, during the *winter progression quarter,* when the negative action of the earth in the annual circle is, as refers to the latter, the *dominant* action:—the changes in the lunar circle *from positive to negative,*—by reason of their *disturbing to a less amount* the existing *equilibrium* of electric action in the atmosphere, than the opposite changes from *negative* to *positive,*—induce less general and marked effects on the weather than the latter changes. And for a similar reason, that, during the opposite or *summer progression quarter,* the changes in the lunar circle *from negative to positive,* induce less considerable changes in the weather than those *from positive to negative.* But, dissimilar to the winter progression quarter,—owing to the superior *tenacity* and force of the equlibrium of electric action in the atmosphere during summer, than in winter,—the lunar changes from positive to negative in summer do not, in general, produce their effects on the weather till towards the close of the negative lunar tides. The contrary of this, par-

ticularly in the higher latitudes, being usually the case in reference to the setting in of the positive lunar tides in winter; and thence the *rule*, that both in summer and winter, a difference always exists, as refers to the relative effects on the weather, induced by the opposite changes of action in the lunar circle.

12.—As, during the opposite progression quarters of summer and winter, the *actual state* or amount of the existing dominant action in the annual circle, from the circumstance of its being for the time the most influential, is that which rules the temperature and other phenomena of the atmosphere;—hence it is that during these quarters, the lunar action which is of *same name* with the existing dominant action in the annual circle, is that which, it may be considered, supplies a *key* to a knowledge of the approaching phenomena of the atmosphere. And thus, when during the summer progression, and transition quarter, rains occur at the periods of the lunar *syzygies*, or shortly after;—a return of cold, accompanied, generally, with *still heavier rains*, and *squally weather*, may be expected at, or shortly after the periods of the ensuing lunar *quadratures*. It may be added that, in proportion to the increase of force in the solar action as we approach the period of the highest degree of annual temperature in summer,—these effects of the negative action of the moon will be observed to lessen;—and that

again, immediately after the latter period, they will be observed to recommence with increased energy, during the remaining part of the summer transition quarter.

When an exception to the rule here stated in reference to the lunar action occurs during the summer transition quarter, it will be found to be during the *first half* of the lunar circle, when the relative *tendency* as refers to the latter is, as already stated, to drought. But such exception, during the first half of the lunar circle will, in general, *be fully compensated for towards its conclusion,* by increased humidity, with its accessory phenomena;—the latter circumstance, in reference to the lunar circle, (similar to what has been remarked in reference to the phenomena connected with the *second* and *fourth* storm crisis in the annual circle, when those by which they are preceded at the equinoxes are but *feebly developed,*)—being, as would appear, an effect arising from *accumulation,* in reference to this species of meteoric action towards the conclusion of the lunar circle, when unequally apportioned with that by which it had been preceded, i. e. when, after rains have occurred during the positive tide of new moon, they have not been succeeded by rains during the negative tide of the *first quadrature*, but have been suspended till the close of the positive tide of *full moon*, and have thence succeeded with increased

force during the negative tide of the *second quadrature,* to its conclusion.

It may be further observed, as refers to our skies,—that when from the period of the summer solstice to that of the highest degree of summer heat by which it is succeeded, *the weather is fair* at the period of the lunar quadrature, it may be considered as presumptive of an approaching change of weather at the period of the ensuing *syzygy*:—the weather during this part of the season, at the periods of the lunar quadratures and syzygies, as remarked, being in general strongly contrasted.

Again, when, during *the winter progression quarter*, *frost* occurs at or shortly after the period of the lunar quadrature,—and thence, according to the degree of its intensity, marks the actual state of the existing dominant action—the negative of the earth—in the annual circle:—the period of the approaching change in the lunar action—from negative to positive, should be looked forward to with increased apprehension, as being pregnant with danger. For, as the force of storm, during this portion of the annual circle, may be said to depend on *the degree of contrast* by which the positive lunar tide which induces it is immediately preceded or followed;—the risks incident to storm, in general, lessen, in proportion to the greater *mildness* of the weather at the period of the preceding lunar quadrature and concluding part of the negative

lunar tide;—and increase in proportion to its greater severity. It follows that *frost*, at, or immediately subsequent to the lunar quadratures during this part of winter, should, as regards the weather, always be considered as a sinister prognostic. And as, during these the opposite progression quarters, and other periods of the year, a relative proportion always subsists between *the forces*, whether as connected with the principle of *contrast*, or *collision*, or both,—in which the violent phenomena of the atmosphere have their source, and these their effects: and further, that, fortunately, the *more powerful* the contributing causes in which this the violent class of atmospheric phenomena has its source, the less liable these phenomena, as regards *the order of their occurrence* in the lunar and diurnal circles,—are, *to be irregular*. Thus it happens, that during the opposite progression quarters,—the more violent and destructive are the phenomena of the atmosphere; the *more regular* they, in general, are, in their occurrence, in reference to the period of the lunar and diurnal circle at which, according to our principles, they should occur:—and *vice versâ*. For, as if aware that their effects must prove harmless,—the class of atmospheric phenomena, originated by the *ordinary action* of he r forces,are those to which Nature seems to have been the least disposed to prescribe any fixed or determinate

limit, in the periods of their occurrence;—allowing them, like some others of her innocuous progeny,—the greater latitude and range, in proportion to the greater amount of their subordinate properties and forces, which thus deprives them of the power to injure.

13.—The phenomenon of *thunder,* when it occurs, is always to be esteemed as indicative of a *tendency to drought* in the region where it occurs,—whether as connected with the lunar, or annual circle,—at the period of its occurrence: and on the contrary the phenomenon of *storm,* unaccompanied by thunder,—as being indicative of *humidity* in the region of its occurrence, at the time,—whether as connected with the lunar or annual circle. And thus it is, that thunder during summer is much more frequent in the southern and middle latitudes, than in those lying farther north; and on the continent, than on islands, circumstances of latitude being the same,—owing to the tendency to drought and heat during this season being greater on the continent than in islands. It may be further observed, that when thunder occurs in our skies in winter,—as it is not of ordinary occurrence,—it may be considered as indicative of approaching cold and frost, in no ordinary degree.

14.—Of the opposite *transition quarters* of the annual circle it may be observed, that though they are those during which the lunar action, for the

reasons assigned, is the least consistent, or to be depended on as connected with the weather;—yet they are those during which the meteoric effects of the *preceding winter* become the most visible. And this, perhaps, is still more fully apparent, during the summer transition quarter—though more distant—than at the opposite period of the year; as then it is, or in autumn, more than in the summer months, properly so called, that, if *mild*, this the mildness of the preceding winter is most perceptible in its effects,—in *the drought* which occurs at this season: as its *severity*—if it has been severe,—by the *humidity* which occurs in autumn,—circumstances of latitude being the same.

It may be further remarked—as being, perhaps, more particularly referable to the opposite transition quarters,—that, as refers to the meteoric influence of the moon,—the weather may at times be observed inclining to, and touching as it were (similar to the descent of the sun towards setting, during the summer months in the polar skies) the verge, to which the existing *tendency* of the lunar tide, whether at its setting in, or going out inclines,—i. e. to drought or rain,—but which the amount of opposing causes to this tendency of the lunar action,—whether as connected with the action in the annual circle, or the nature of the locality,—arrests in its course, and prevents from progressing beyond such limit in the line of its development.

Appearances, or approximations to results only,—but at the same time sufficiently marked, whether in the currents or otherwise, as not to be mistaken, —thus, not unfrequently showing the existing *tendency* of the lunar action on the atmosphere, with out a change of weather actually taking place.—On the other hand, it is not unfrequent to see the existing tendency of meteoric action in the annual circle, equally counteracting, to a certain extent, the opposite tendency at the time in the lunar circle, without any material change in the weather being the consequence.

15.—As refers to what are called *hoar* and *black* frosts,—I think it necessary to observe, that, though both have their source in common in the descent of temperature below the freezing point: yet, as during the winter progression and transition quarters, such falls of temperature not unfrequently originate in principles totally opposite to each other, and that they are usually succeeded by dissimilar, though very important results, in reference to the weather, some notice of these peculiarities in this place may be desirable. The first circumstance to be noticed in reference to these frosts is, that whereas, *hoar frosts* during the winter season usually occur at, or shortly after the commencement of the lunar tides—positive or negative—*black frosts* rarely set in but during the *negative* lunar tides, and at or shortly after the *quadratures* :—thus, not only by the dif-

ference which occurs in their *appearance* and duration, but in the periods of their occurrence in the lunar tides, showing the difference in the principles in which they have their source. It will be recollected, as an assumption of our theory, that extremes of temperature in the atmosphere in summer or winter are never effects of the *direct*, but of the oblique or *concentric* action in its inferior region of the existing dominant force—positive or negative, according to the season—induced by the commencement of an *opposite species* of meteoric action at the time, in the region where such concentration produces this its effect on the temperature,—sufficiently apparent, as noticed elsewhere, from the greatest heat by day not occurring at *noon*, but about three hours after; and from the greatest cold not occurring at *midnight*, but a little after the dawn of day—being in each case an effect of *concentration*, caused by the commencement of an opposite action of the *same species*. And the period of the setting-in of *black* frost in the lunar circle towards the *conclusion* of the negative lunar tide, or period of the incipient action of its opposite,—shows, not only that the principle in which it has its source, is the same as that which induces the extreme degree of cold in the diurnal circle, as noticed, but that it is likewise an effect of the *same or direct species* of electric action. And were this the only species of meteoric action by which such concen-

tration in the inferior region of the atmosphere were induced, it had stripped the subject of much of its complexity. But meteoric action being of *opposite species—direct* and *inverse;* and the site of the first being in the *inferior,* as that of the latter action is in the opposite or *superior region* of the atmosphere; from which it gradually descends to the region next to the earth's surface: and thus, that the co-existence of the latter in the superior region, with the former in the region next the earth's surface, continues, at times, for periods more or less considerable;—this causes that during its descent from the superior region—similar to the changes in the direct species in the diurnal and lunar circles,—as being of an opposite kind to the dominant action in the inferior region, it has, similar to the former, the effect of causing *concentrations* of the direct species of electric or meteoric action in the inferior region of the atmosphere; and consequently, of inducing all the effects on the temperature, whether in summer or winter, incident to the changes in the latter. Now, when such effects on the temperature are equally produced by causes so different, it will not surprise if extremes of temperature induced by the one, should be followed by phenomena totally different from those induced by the other.—Extremes of temperature induced by changes in the direct species of electric action being seldom the immediate precursors of changes in the weather: whereas those incident to descents of the meteoric

convergencies from the superior region, in which the inverse species of electric action has its source, invariably prove the immediate precursors of the most violent atmospheric phenomena of the year, whether in summer or winter. And, reverting to the subject of *hoar* and *black* frosts, during winter,—as nature usually affixes *a mark* to distinguish her several productions and phenomena one from the other—whether of the same, or of a different genus,—so it is in reference to these opposite species of frost,—those caused by the descents of electrical convergencies in which rain and its accessory phenomena of storm, &c. have their source, being usually *hoar frosts*, and of short continuance; as those having their source in the changes of the direct species of electric action, are, as distinguished from the latter, denominated *black frosts*;—which, though not so frequently as the former, are, notwithstanding, at times, the precursors of storm.—And as if the difference in the appearance and duration of these frosts were not sufficient to distinguish them—similar to the inversion of the colours observable in the *double Iris*,—the order of their occurrence in the lunar tides are entirely reversed one to the other. It may be further observed, that as the occurrence of black frost—which rarely is the case with us, to any extent, till after the period of the winter solstice—is indicative of *force* in the development of the dominant or negative electrical action in the annual circle at the

time in the region where it occurs; so, on the other hand, the occurrence of hoar frost is usually indicative of an *artificial* state of the temperature, at the time, arising from *local* causes, as the proximity of the sea, &c., in the region where it occurs. —It is right to add, that the storms, of which hoar frosts are, in general, the precursors, sooner develop themselves about the periods of the equinoxes, than towards that of the winter solstice: as, during the former periods, these gales usually follow, in the course of *twenty-four* hours; whereas in November, the worst of these gales rarely occurs till the *third*, and still nearer to the solstice, not before the *fifth*; and after the solstice, at times, not till the *seventh* day which succeeds this species of frost.

But as there is no general rule without its exception—when the chief *storm crisis* of the winter progression quarter is over,—the same degree of violence, in reference to the gales which succeed hoar frosts, is not to be apprehended again to its close.

16.—So much of the present work being directed to the important subject of *storm*:—it may be right to observe, that storms, the same as ordinary winds, have their source in one common principle, viz. the changes—more or less considerable, which are almost always taking place, with the changes of its temperature in the *equilibrium* of the atmosphere. For where, as in the lower latitudes in summer, and in the higher in winter,—by reason of the extreme

force, at the time, of the existing dominant action in the annual circle on the temperature,—this the principle of its equilibrium in the body of the atmosphere, —as shown by the height, and slight variations of the mercury in the tube of the barometer, is the most powerful, and firmly established,—the variations, whether in the force or direction of the winds, are the *least*. And where, as in the central and higher latitudes in summer, and in the former and lower latitudes in winter, this equilibrium,—owing to the *want of force* in the existing dominant action,—is the least firmly established—as shown by the frequent changes of the barometer,—the variations in the force and direction of the winds are the *greatest*.

And as the incipient or first effect of the action of the opposite primary forces in the annual circle after the periods of the equinoxes, is less identified with the principle of its temperature, than with the currents, and inverse species of electric action in the atmosphere, till by means of this action a mean or relative standard of the equilibrium of temperature is established throughout the various regions of the same hemisphere;—and that the same analogy exists in reference to the action of the primary forces in the diurnal and lunar circles;—thus it is, that though the least affected by its variations,—it is the force of the equilibrium of temperature in the vicinity of the main focus of the existing dominant action in summer and winter, which constitutes the

mainspring or source from which the impetus of storm, during these seasons, whether in the vicinity of such main focus, or in the latitudes more or less distant from the latter, is derived.

Thus, for instance, during the winter progression quarter, the *equilibrium* of temperature being the most firmly established in the vicinity of the pole and higher latitudes, or site of the main focus traversed by the existing dominant action—the negative of the earth,—and—other circumstances being the same—least firmly established in proportion, as from these the higher latitudes we descend southwards;—this the equilibrium of temperature may, not unaptly, be compared to *a tree*, from which, at the pole, *two* principal arms extend horizontally along the opposite grand continental *reflectors* of Europe and Asia on the one hand, and of North America on the other.—Both of these its chief meteoric arms, as stated, lessening in force as they advance in the direction of the tropic; the lateral branches from which project on either side, and unite across the intervening, or Atlantic, and North Pacific Oceans; thus embracing within their range—though with very different modifications and degrees of force—the entire of the northern hemisphere. Again, suppose this widely extended electrical or meteoric tree, continually exposed to, and acted upon, by a succession of minor but opposite impulsions, alternately, derived from the opposite actions,

—positive and negative—in the diurnal and lunar circles:—it is easy to see—if our principles were correct—that where the force of the equilibrium of temperature in the atmosphere was greatest, would not be that where these conflicting impulsions produced their most frequent *perceptible* effects, but in the opposite direction, i. e. in the middle and lower latitudes; which, being more distant from the source of the dominant action, were those, necessarily, the least affected by the latter;—and, consequently, owing to the comparative weakness of the equilibrium of temperature in their atmosphere, these were the regions where such alternate impulsions—from the continual state of change to which they exposed them—should produce their most sensible effects. Now, if one of these minor electrical impulsions in each of the smaller circles, were of the *same name* as that of the existing dominant action in the annual, it would necessarily have the effect during its continuance of giving increased force to the latter. And where the force of the equilibrium of temperature in the higher latitudes, and in the interior of these continental reflectors was such, as not to be *overthrown* by the impulsions in the minor circles which were of an *opposite* name,—this increase of force given to the dominant action in the annual circle, by the impulsions of the same name in the minor,—would—as should be the case—be sensibly felt in the temperature. But along the

more distant, as lateral branches of this electrical battery,—where, as on or in the vicinity of the ocean, whether from the weakness of the dominant action in the annual circle, or the radiation of heat from the waters of the former, a weak, or *artificial* state of the temperature existed; that the electrical impulsions in the minor circles which were of the same name as the dominant action in the annual, at the periods of their *setting-in*,—instead of their forces being developed on the temperature in the first instance, as in the former case,—these their forces would, on the contrary, be only felt as regarded the weather, in the production of rain and its accessories—storm, &c.—incident to the process of *approximating* the temperature of such regions, (by the removal of the redundance of their calorific base,)—to the temperature inland, or more distant from the sea; where its equilibrium had been less affected by the opposite series of these minor impulsions, till such approximation was effected. And thus, if at all, that it could only be towards the *conclusion* of these minor impulsions of the same name with the dominant action, that, under such circumstances, their effects on the *temperature* could become apparent. Under these circumstances, I say, the same impulsion in the lunar circle—(as being the largest and most influential of the minor circles,)—which, in the higher latitudes, and in the interior of these continental reflectors, at distances

more or less considerable from the latter, (where the equilibrium of temperature continued sufficiently powerful,)—produced but an augmentation of cold and frost;—would, at the same period of time, produce only *rain*, with its accessory phenomena of *storm*, within the same parallels, in the atmosphere of the sea and of islands;—till, by the increase of its force with the advance of the season, an approach to the equalization in the equilibrium of temperature between the latter and former regions were effected, in such way as that the action of the impulsion went *equally* to affect the principle of temperature in both.—If, however, that beyond a certain latitude south—whether in islands or on these opposite continental reflectors, there existed regions where, during winter, *frost* was either unknown, or but rarely occurred;—and where, of course, a sufficient approximation in the equilibrium of their temperature with that of the regions lying further north, where it existed, were not sufficiently effected at any time, whether by these minor impulsions in the diurnal or lunar circles, or by that still more influential one in the annual:—and that the rains and storms in such regions originated by these impulsions of the same name in the minor circles, instead of ceasing towards the periods of their conclusion, were only *renewed* by the setting-in of the opposite class,—simply by the effect of *rebound* in the principle of temperature in these

regions, which they induced:—thence it would follow, that while the atmosphere in the vicinity of the Pole and in the higher latitudes during winter, enjoyed an almost uninterrupted state of *repose*,—from the preponderating force and influence of the equilibrium of its temperature;—such repose would be more frequently interrupted during this season, in proportion as with the gradual decrease in the force of this equilibrium we advanced southwards:—and, finally, that beyond a certain latitude south, where throughout the season this equilibrium were not sufficiently established,—similar to a tempestuous sea under the action of conflicting winds—the effect of these opposite impulsions on the atmosphere in the minor circles would be, to keep it in an almost continual state of change and agitation.

Now, by contrasting this assumed sketch with the reality it is intended to represent, it will not be difficult to determine whether it be true to Nature or otherwise. And if admitted to be true in all its parts,—to these the continual and important variations in the weather, during winter, in the middle and lower latitudes, as being chiefly effects of the changes in the *lunar circle*,—and not to the casual occurrence, or non-occurrence of *rain*,—(which, under certain circumstances, the slightest change or eddy in the currents of the atmosphere, is sufficient to suspend or induce,)—I would beg to direct atten-

tion,—in order to a solution of *the question of the lunar action on the weather*.

In the above circumstance will be likewise found the cause of the necessarily *local range* of storm, whether in winter or summer: and how it is, that, by the gradual increase of force in the negative electrical tide in the *annual circle,* from the commencement of the winter *progression*, to the setting-in of its *transition* quarter,—the phenomena, whether as connected with the principle of atmospheric temperature, or otherwise, (at first confined to the higher latitudes,) gradually descends to those lying further south;—till, finally, an approximation is effected between them, such as, conformable to the wise intentions of Nature, is consistent at once with perpetuating the salubrity of the atmosphere, and the well-being of the animal and vegetable kingdoms, throughout the entire hemisphere.

It is hardly necessary to add, that, as refers to the summer quarter of the year:—by *reversing* with the change of temperature, the position of this electrical tree or battery in our hemisphere, i. e. placing its base to the tropic, with its arms and branches gradually lessening as it extends in the direction of the pole,—that the same reasoning and circumstances, as in the former case, will be found equally to apply to the latter season, whether as refers to the temperature, the currents of the at-

mosphere, the chief site of storm, &c.; only substituting, during the summer, the higher ranges of mountains for the sea,—so as to show that the same *enchainement* or consecutive analogies equally pervades both. And, as being conspicuous in the list of these analogies, it will not fail to be remarked,—as contrasting one year with another—the relative dependance, as shown by the positions they occupy in the annual circle, which subsists between the chief storm crises of the summer, and winter progression quarters, and those of the equinoctial seasons by which they are preceded; and of both with the relative drought or humidity, and extreme degrees of annual temperature by which they have been preceded—other circumstances being the same—as noticed in a former part of the work. And, secondly, the dependance which subsists between the various degrees of the *violence of storm*, during winter and summer, and the relative force of the equilibrium of temperature at the time, in the region where it occurs. Thus it is, that when storms occur in the higher latitudes during winter,—similar to that which caused the inundation of St. Petersburgh, on the 19th of November, 1824;—or in the lower latitudes during summer,—they are generally more terrific and destructive in their effects, than storms which, at the same periods, occur in the middle latitudes. And that, as in proportion with the advance of either of these seasons to the oppo-

site annual extremes of temperature, the force of the equilibrium of temperature in the middle latitudes increases,—the force of storm is likewise found to increase, and to become more destructive in its effects than before.—The relative violence of the one, generally quadrating with the degrees of *contrast* subsisting between the action of the opposite primary electric forces in the annual circle at the time, as the latter with the relative force of the equilibrium of temperature.

17.—That calculations in reference to the approaching phenomena and changes of the weather founded on our principles, as contrasted with those derived from the changes of the barometer, are, at times, not only more to be relied on, but are *much in advance* of the latter, the following facts will sufficiently prove. Thus, in reference to the assumed connexion of *hoar frost,* at or about the periods of the lunar *syzygies*, during the winter progression and transition quarters; but more particularly towards the period of, and for some time after the winter solstice, when the interval (as remarked,) which separates these phenomena, is most considerable.—I have known the barometer, *after* the occurrence of hoar frost, (as at the period of *new moon*, on the night of the 11th December, 1833,—notwithstanding that one of the most violent storms of the season was on the eve of setting in, and of the approach of which I had apprized a

friend on the morning of the 12th,)—continue to *rise* during the *three* following days; insomuch, that it was not till shortly before the setting-in of the gale on the 16th of December, that a change in the barometer indicated its approach; hoar frost thus being, as a prognostic, more than three days in advance of the barometer, in pointing out the impending danger.—So rarely, indeed, during winter, or the period of the equinoxes, have I found *hoar frost* not the certain precursor of *storm;* and so much am I, consequently, in the habit of associating the latter with the appearance of the former,—that when I observe hoar frost during these seasons, and the bright unclouded sky and delusive calm, by which it is accompanied: I can only compare my feelings, in contemplating the brooding destruction which, even at the moment, is silently impending over the deep,—to those of a person standing on, and excepting the explosion of a mine beneath his feet.

18.—The winds or currents of the atmosphere which have their source in the changes of its temperature, —and they, it may be observed, are the most common—resemble other currents in this, that as the impetus of the latter is determined by the volume of the moving fluid, the amount of the fall, and the abruptness of the change with which it passes from a superior to an inferior level; so the force of these winds is in proportion to the amount and abruptness of the changes of temperature, whether

of descent or ascent, in which they have their sources; and of the volume of the atmosphere affected by those changes.—The greater the amount of change in the equilibrium of its temperature, the more sudden the transition, and the greater the volume of the air affected thereby,—the more powerful the wind or current it originates; and *vice versâ.* Of the opposite and more violent class of the winds, or those which have their source in the formation of rain in the middle or superior region of the atmosphere, it may be observed, that during summer and autumn in mountain regions, and particularly in southern latitudes, though *fog*—so usual a precursor of rain in such regions—may form and threaten, for longer or shorter periods, the approach of the latter;—it is not before fog is accompanied or followed by *gusts of wind*, that any immediate change need be apprehended. Such gusts of wind, from demonstrating, as they do, the *loss of its equilibrium* in the superior region of the air, and which can only take place by the setting-in of the inverse species of electric action,—being, under these circumstances, the certain precursors of an approaching change of weather.

Of the latter or violent class of the currents of the atmosphere which have their source in this the loss of its equilibrium incident to the setting-in of the *inverse species* of electric action in its superior region, as contrasted with the conjoint product of this

action—*rain*—on such occasions; the following important difference is observable, viz. that whereas *the loss of its equilibrium* in the body of the atmosphere after an interval of fair weather,—which is acccurately indicated by *the fall*, as its subsequent recovery by *the rise* of the mercury in the tube of the barometer—is, if *sudden* and *considerable*,—not only an infallible sign of approaching *rain*, but of *storm*;—the violence of the latter, as its proximity, being usually in an exact ratio with this the suddenness and *amount* of the loss of its equilibrium. On the contrary, however, from the moment when subsequently the body of the atmosphere *begins the recovery of this its lost equilibrium*,—as indicated by the gradual rise of the mercury in the tube of the barometer—the phenomenon of *storm* ceases; and this notwithstanding that the progression of such recovery of its equilibrium is—particularly at its commencement—equally sure to induce the occurrence of *rain*, as at or during the period of its preceding loss. Thus, the recovery of its equilibrium on these occasions by the body of the atmosphere, *while it continues to progress consecutively*, is accompanied by *calm*, or the suspension of its violent currents; notwithstanding the—at times—frequent occurrence of rain during such periods. It is necessary to observe, however, that if, as sometimes happens—particularly during the *equinoctial phenomena*—that after a considerable fall

of the mercury in the tube of the barometer, i. e. approaching to the point which on the scale is marked "*stormy,*" and while it is gradually but, perhaps, slowly, with the recovery of its equilibrium by the body of the atmosphere, re-ascending, but has not as yet reached its ordinary level at the part of the scale marked "*fair;*"—that its further consecutive rise becomes ***suddenly arrested.*** This circumstance should not be overlooked—even though the mercury in the tube of the barometer should continue ***stationary;*** as it is, in general, indicative of the return of ***storm*** with its accessory phenomenon of rain.

19.—It is an assumption of the present theory that by means of the action of opposite electrical poles diverging from a centre in the middle region of the air, and round which they revolve with the diurnal changes of meteoric action morning and evening,—the body of the atmosphere is divided ***vertically*** into opposite electrical regions, i. e. into regions, the aggregate masses of whose electrical aeriform bases are of ***opposite kinds.*** And did there exist no other proof of the correctness of this assumption than that furnished by the ***site*** of the formation of rain-clouds in its body, the latter fact, of itself, were demonstrative: owing to the opposite electrical elements of water—***oxygen*** and ***hydrogen***—in this the process of its formation in air, not being drawn exclusively from

either the superior or inferior region, but *from both.*

It may be further observed, while on this subject, that the various degrees of perfectibility in the decomposition of atmospheric air,—a circumstance which exercises so considerable a sway on the development of its other phenomena—depends on the various degrees of the more or less perfect separation of these its opposite aeriform electrical bases—oxygen and hydrogen—between its opposite regions in the scale of its ascent: and that the degree of the latter is usually conformable to that of its *transparency.* Thus, where the action of the existing dominant primary electrical force in the annual circle is most powerful at the time,—as in the *lower* latitudes in summer, and in the *higher* in winter,—the more perfect, at once, is the decomposition of the air, and consequent separation of these its opposite aeriform electrical bases between its opposite regions;—the more perfect likewise is its transparency; and the more copious the *fixation* of the aeriform electrical base of the existing dominant primary electrical force at the time, in its inferior region; and *vice versâ.*

20.—Changes of the weather which are indicated by *sudden changes of the barometer,* equally as *sudden changes in the weather,* whether or not indicated by the barometer, *are rarely of any long continuance,* and consequently are not to be much

relied on. These sudden changes in the weather during the *solstial* quarters when they are most common, are usually effects of the temporary *eddies* in the atmosphere which mark the periods of the lunar *octants*, or intercalaries, which occur between tbe expiration of one lunar tide and the setting-in of its opposite by which it is succeeded. The more powerful action *in the annual circle* under these circumstances, from its being the chief *moteur* of the weather, shortly causing a return of the same atmospheric phenomena as those which prevailed at the conclusion of the lunar tide which preceded such intercalary, after the setting-in of the lunar tide by which it is succeeded:—the action in the annual circle, from its superior force, thus blending the *opposite actions* of the moon in the same phenomena.

21.—Of so intimate a nature, as assumed, is the union subsisting between the local action of gravity, magnetism, and electricity, in the sun and planets, that any circumstance which should impair the action of any one of them, would have for effect to impair to a like extent the action of the others. And, as the bond of the union and local energy of these forces, whether in the sun, as constituting in itself one grand division of the solar system,—or in the planets, as constituting the other, is, according to our theory, based on the principle of *reflective action.* Thence it would follow, assuming our

theory to be correct,—that any interruption or suspension of this reflective action, as regards that of the sun by the planets, or that of the planets by the sun,—as it went to sap the bond of this the local action of these forces on these bodies,—would have for effect no less than ***a separation of their elements;*** and the consequent return of chaos.—Such, and so vitally important to the existence of these bodies is esteemed to be the influence of a principle heretofore so little noticed or taken into account in astronomy, as to have been, up to the present, hardly so much as thought of. And have we not, it may be asked, some evidence of the fatal effects on the whole frame of nature which would be the consequence of a suspension of this reflective action, in the extraordinry sensation which is observed to be produced on man, and other animals, by its *partial suspension*—though but momentary—during *eclipses of the sun;*—a sensation, it may be observed, totally different from that caused by sunset;—and, as described by Mr. Stukely, to his friend Halley, in an account of an eclipse of the sun observed by him from Haradon-Hill, near Stonehenge,—which produced so frightful an effect—to use his own words, "as though *it announced the dissolution of nature:*" —even the horses, as he describes it, being so sensibly affected and dismayed thereby, that, as if seeking protection, they "pressed close to them" during its continuance. And thus, it may be added,

some new features in the all-wise and beautiful dispositions of Nature, in reference to the heavenly bodies, are brought to light. For, assuming the indispensable necessity of an uninterrupted continuance of this reflective action, reciprocally, between the sun and planets,—by it we are led to see, not only the necessity which existed for the *mass of the sun,* as being the main centre of this action in the solar system, being, as to *dimensions* so much superior to the masses of the planets:—but for the gradual *diminution* or falling off in the size of the planets, as their relative positions in the system bring them nearer to the sun, in order that this their size, as contrasted with the latter, might no more than *partially* affect his reflective action, on those lying beyond, or more distant from him, during the periods of their *transits*, or crossing the paths of the latter. By this view of nature we are likewise given to understand the necessity which existed for *the amplitude of space,* employed in reference to the relative positions of the planets to each other;—in order that, notwithstanding their revolutions round the sun being made in the same plane,—*eclipses* should not result from their interposing one with the other in reference to the sun.—These their distances from each other being calculated so as to cover the projecting range of their *shadows* during the periods of their transits one from the other.

To this, then, the reflective action of the heavenly bodies on each other,—*positive* and *negative* —as to its source, we may trace that fullness of nature in her operations; which, as this its cause, admits neither of vacuum or interruption;—as by it we are taught the condition of that *unity*, which, however widely detached and separated from each other in the regions of space traversed by them, subsists between the several members of the solar system;—constituting, as it does, the bond on which both the harmony and very existence of these bodies is based. By it, indeed, only, it is, that we are given to see, that this the principle of unity in nature is such, and so perfect, that nothing therein is partial or detached, but integral and collective. That *time* and *distance* are but *relative terms;* and only applicable to fractional parts of an immeasurable and incomprehensible whole.—And that though perfectly distinct and dissimilar in their nature, there are but *three* things—as of a family—connected with this mighty universe, which are to be considered as in some sort commensurate and worthy of being classed with each other, viz. THE GODHEAD, or governing and directing INTELLIGENCE; the IMMENSITY OF SPACE, with its population of worlds; and ETERNITY;—and that, as it may be said to subsist by their *unity*, they can only be expressed by its type.

APPENDIX.

BRIDGEWATER BEQUEST.

Copy of a Paper addressed to John George Children, Esq., Secretary to the Royal Society of London, &c.

Dublin, 15*th February*, 1834.

SIR,

HAVING, in 1830, published an astronomical work entitled "Rudiments of the Primary Forces of Gravity, Magnetism, and Electricity, in their agency on the Heavenly Bodies," a copy of which, my highly respected countryman, N. A. Vigors, Esq., M, P. &c., did me the honour to present to the Royal Society of London, in December, 1831; and as the views therein taken, as to the sources of the eliptical and rotary movement of the heavenly bodies, but more particularly of those of planetary temperature; by which—for the first time—it is shown that this principle is *local* in its nature, or confined in its range to the atmospheres of the sun and planets: and thence, by means of what simple dis-

positions—as in animals—nature has established throughout these bodies the same standard of mean temperature,—as explained in the leading article under the head "Introductory Observations." As, I say, the views taken of these phenomena in this work go much further—assuming them to be correct—in demonstrating the wonders of *Creative Wisdom,* as manifested in the creation, than has ever been shown by any preceding writer on the subject,—and being lately apprised of the munificent bequest of the late Earl of Bridgewater, to the author of a work on astronomy such as should the most fully demonstrate "the power, wisdom, and goodness of God as manifested in the creation;" and it being at the time suggested to me that, under the circumstances stated, it were culpable in me not to set up a claim thereto; this I am the more induced to do at present, from the disappointment expressed by the writer of a very able article in the last or January number of the *Edinburgh Review,* on a work entitled "Astronomy and General Physics considered with reference to Natural Theology," by the Rev. William Whewell, M. A. &c.; and, as would appear, written and published by the latter, in compliance with the instructions of the Committee appointed to carry the intentions of Lord Bridgewater, in reference to this bequest, into effect. Indeed, it may well be doubted whether any work or works, that either are, or could be *got up* for the

occasion, however ably executed, are likely to meet the object contemplated by the noble testator, so long as the limited and very imperfect views which prevail, in reference to the grand mechanism of Nature in her economy of the universe, obtain currency. And this for the simple reason, that in the absence of correct astronomical data, the wisdom and goodness of God, as manifested in the creation, and which constitute the sum and substance of natural theology, cannot be exhibited or made appear in their true light. In proof of this may be cited the errors—as I hope to prove—fallen into by the reverend author of the work alluded to, in assuming that natural theology can ever give us other than "manifestly imperfect and incongruous conceptions concerning the Deity, his mode of effecting his purposes, or the scheme of his government;" which is entirely at variance with what appears to be the more rational and just view of the subject, viz. that as the Divine Architect may be supposed to have modelled on *perfection* the whole of the plan and dispositions connected with the wondrous works of the creation. That, as is justly observed by the writer of the article in the *Review*,—"as science widens its range, and discovers to us new powers of nature, and new sources of beneficence, our natural theology must advance in the same proportion;" and consequently, that it is only from our imperfect conceptions of nature, and, similar to the

great Newton, by trusting to *false lights* in forming estimates, as to the actual state of temperature,—the action of gravity, &c., in the other planetary bodies of the solar system; that—as things beget their like—such an erroneous assumption as hazarded by the reverend author, in this instance, is to be ascribed. And, in proof that this is not the sole incongruity to be met with in the pages of the work alluded to, may be cited the assumption of the author, as I find it copied into the article in the *Review*, viz. as "*there is a resisting medium*" in the regions of space traversed by the heavenly bodies, "therefore, the movement of the solar system cannot go on for ever." For, instead of this *medium* or atmosphere, which, it is now generally admitted, exists throughout the solar system, acting as a *hinderance* to the motions of the planets;—it, on the contrary,—as may be found stated in my work—is assumed to constitute the connecting chain or conductor between the entire of these bodies and the sun; by means whereof the primary forces of gravity, magnetism, and electricity, inherent in them, cause them to act on each other in upholding,—together with the vital principle of *heat*—their movements both orbital and rotary; and consequently, without which, the entire of these phenomena, in reference to the sun and planets, would cease. And if, in turning to the part of the reverend author's work which treats of the harmonies observed to subsist

between the constitution of animals and plants, and the length of our year, &c. :—how much more fully and forcibly—with his admitted talents—could he not expatiate on this part of his subject, were he but aware—as I feel warranted in assuming—that not only is man a *microcosm*, as supposed by philosophers,—but that, in a similar sense, every other animal and *plant* presented to our observation over the entire superficies of our globe,—is to be regarded in the same light! As each, and every one of these individually may be said to combine in miniature, though with modifications varied to infinity, an ensemble, not only of the original elements of which the great world is composed, but of the active forces and dispositions by which vitality is upheld in the latter. Nature, in her organic creations, except in the variety connected with their combinations, and modes of application,—never varying either her materials or principles of action. The latter, even in her minutest organic productions, being never other than the reflection or repetition of herself, as regards the means she employs in upholding the vivifying principle in those glorious orbs in which they are placed. The entire of these her minor creations, whether as regards the earth, or other of the heavenly bodies, being—according to the peculiarities of their respective constitutions—only to be considered as *scions* ingrafted by her hand, at—as would appear—very different periods,

along the numerous ramifications of those widely-extended and immense oceans of vitality presented by the respective superficies of the sun and planets, sustained and diffused by the action of her forces from their centres—as from the hearts of animals—to their furthest extremities or poles:—coeval, it may be said, with the principle of their temperature, or *heat* in their atmospheres; and which, it is assumed, must continue to subsist with its presence, while the action of the forces which perpetuates it shall remain unimpaired. And, as in the principle in which planetary heat or temperature has its source, as assumed, is *reflective action*, which is but another name for *collective action*. This proves that in the scheme of being, originally projected by the All-wise Creator of the universe, UNITY constituted its ground or basis; as nothing in the material world is, or, according to those principles, could be, isolated, or other than *relatively detached:* for, however widely separated are the sun and planets from each other, they, nevertheless, constitute but an ensemble or whole, wherein none of the parts are independent of the others, but in which each is held to contribute to the sustaining action which vivifies it, and, consequently, is necessary to the well-being of the remainder. Thus, in a word, showing that the fundamental principle of union and *mutual dependance* which forms the basis of the *moral*, is but the counterpart of that which con-

stitutes the ground-work of the *physical world.* And which, as it is equally held to be the fundamental principle of *revealed religion*, goes directly to prove the incorrectness of the principle assumed by the Rev. W. Whewell, viz. that our natural theology can give us but "imperfect or incongruous conceptions concerning the Deity, his mode of effecting his purposes, or the scheme of his government." But that, on the contrary,—rightly understood—natural theology was the one thing wanted, in order to demonstrate, and for ever place beyond all doubt, *the divine origin of revealed religion.* Thus showing the importance of having, at length, arrived at the knowledge of correct astronomical principles,—a no small concurring proof of which will, doubtless, be found in this the strictness of their conformity with those on which the fabric of the moral world is founded,—even on the score of theology and revealed religion. But, however important on the score of theology,—when we come to consider the magnitude of the difficulties with which the entire circle of the sciences connected with the animal and vegetable kingdoms have had to contend, in the absence of correct astronomical data, i. e. as regards the important effects on both, incident to the variations in the conjoint action of the magnetic and electrical forces which preside over the atmosphere and its phenomena;—more visibly depicted, it may be observed, in the

variety which characterizes these kingdoms in the *eastern* and *western,*—and still more in the *northern* and *southern* hemispheres of the earth, than in the principle of temperature itself.—When, in a word, we are arrived at a correct knowledge of these the true principles of Nature in her economy of these kingdoms, and of the endless variety in the adaptations subsisting between the constitutions of animals and plants, and those of the variations in the relative action of the electric and magnetic forces on the atmosphere, which constitute those of *climate:* —it is easy to see that it must be the means of opening a new and important era in the sciences of medicine, botany, &c.

The part of our subject, however, which may be considered as of most importance, is that more immediately connected with *meteorology,* or the changes which take place in the seasons and weather. But, together with its being at once the most conclusive as to the correctness or incorrectness of the principles assumed, from its abounding with the most numerous or every-day proofs,—it was likewise that, by far the most difficult to arrive to any thing approaching to a correct knowledge of. Insomuch, that even *after* the discovery of the true theory of temperature, so much of this knowledge depended on *observation,* that it could only be the work of *time.* I am happy to say, however,—owing to my great application to the subject for some years,—

my industry has been so far successful, that I am at present prepared to offer the world a *Guide to the Seasons and Weather*, such, as had it but appeared before the late disastrous winter,—much of the enormous losses, both in property and life, induced by its *storms*, might have been spared to the country and society. In proof of this, and of the correctness of the principles assumed by me, in reference to calculating in advance the nature of the approaching seasons and weather, I am prepared—at the desire of the Royal Society, to lay some papers before it on these subjects, which, I fear not, will satisfy its members, as to the *practicability* of such calculations.

May I be permitted to add, that, aware, either the march of astronomical science and of truth must cease, or that the period could not be distant when circumstances would concur to show the correctness of the principles assumed by me in my published work alluded to,—I have submitted, in silence, to the slights, neglects, &c. &c., which, in common with much more distinguished men, who, like me, had the temerity to broach any thing original in this science,—both the work, and its author, have experienced to the present.—And, accordingly, by reference to the article in the *Edinbargh Review*, already alluded to, it will be found that the admissions there cited from the writings of Encke, Airy, Hamilton, &c., in reference to the existence of an aeriform *medium*, or universal atmosphere in the regions tra-

versed by the planets, are so many approximations to the principle of its existence assumed by me in this work. And I feel no less confident, that every succeeding day's observation and reflection, will but lead men of science to the same conclusions with me, in reference to the sources of orbital and rotary movement in the sun and planets;—of *temperature*, and its being confined to the atmospheres of these bodies: and finally, that the whole of these movements and phenomena are based on *reflective action*, conformable to what I have advanced in my published work on these subjects.

Trusting, Sir, to your accustomed urbanity and indulgence, in reference to communications similar to the present, addressed to you,—and to your expressed willingness, in your letter to Mr. Vigors, written in December, 1831, (which he did me the honour to inclose me at the time in one of his,) to attend to any communication of mine;—I beg you will do me the honour to present the present paper at the next meeting of the Royal Society.

I have the honour to be,

Sir, your most obedient, and

Most humble Servant,

P. MURPHY.

*To John George Children, Esq., Secretary to the Royal Society of London.**

* This Paper, as here directed to Mr. Children, to *Somerset House*, London,—as being the ordinary mode with papers intended for the Royal Society,—was (post paid) addressed through the medium of the General Post Office.

Supplementary Paragraph to the Paper addressed to Mr. Children.

In reference to this paper, I have simply to observe, that not only was the claim thus set up by me to the "Bridgewater Bequest" unattended to; but that, neither through Mr. Children or any other, has its receipt by the Committee of, or by the Royal Society of London, been so much as acknowledged. And my motive in giving it publicity is, to show that—as I understood—previous to any appropriation of the Bridgewater Fund, I had, as stated in the paper, set up a claim, founded on the expressed conditions of Lord Bridgewater's will, to this his bequest. This I did, from having published a work in which "the power, wisdom, and goodness of God, as manifested in the creation," are made more fully apparent, than what they have ever been by any preceding writer; because, for the first time, the proofs and arguments advanced in reference to the wisdom of God, as manifested in the creation, are not dependant on the vagueness of surmise or conjecture; but, from being founded on facts, are necessarily the more conclusive, derived, as they thus are,

from their primary and unalterable source. Without which,—connected as these facts and arguments are with the discovery of the *first cause,* to and from which, as their centre, the whole of the dispositions of Nature in the creation are referable,—it were impossible to place the power, wisdom, and goodness of God, as manifested in the creation,—being the condition required in *the "published work,"* by the noble testator, in reference to the appropriation of this his bequest,—in such harmonious and bold relief as that in which they are there set forth. I may further observe, that there are occasions in which,—except at the expense, and by the abandonment of principle,—it is not optional with a man as to the course he should follow:—and where, consequently, that species of modest diffidence, which is the ordinary accompaniment of real merit, however congenial to his feelings, must be laid aside, and give place to the more stubborn demand of justice and duty. And so much do I feel the latter to be the position in which I find myself placed with the Committee of the Royal Society, in reference to its appropriation of the Bridgewater Bequest, that, without an abandonment of the cause of truth, and the interests of science and society, as connected with the principles advanced by me in my present, and former astronomical work.—I find myself, in some measure, constrained, to arraign at the bar of public opinion, its decision on this occasion.—The

committee should bear in mind, that this fund *was not of its coinage:* and, consequently, that *favouritism*, on the part of the Committee, in the appropriation thereof, were but another name for *injustice*. And, that I am not singular in the opinion, that the Committee of the Royal Society, in disposing of this fund to the authors of the "Bridgewater Treatises," as the works got up by its direction, for the occasion, are called, has not complied with the conditions required by the testator,—I would beg to refer to the article in the January number of the Edinburgh Review, already alluded to, on the Reverend W. Whewell's Prize Work, entitled, "Astronomy and General Physics," &c. As in this article, which, as coming from so respectable a quarter, will be considered as no slight authority, —it will be seen that, notwithstanding the encomiums so justly merited, and freely bestowed in it on the author:—so unsatisfactory had some of the views advanced by him in this work, appeared to the writer, combined with what he denominates "the injudicious appropriation of a sum of nearly ten thousand pounds," that he concludes his observations thereon, by suggesting, that, "as the work which the Earl of Bridgewater contemplated in his bequest *has not been composed*," "one of the eight authors, who is pre-eminently fitted for the task by his acquirements as a natural philosopher, should be requested, by the trustees, to execute a popular

volume out of the materials furnished by himself and his coadjutors." * And, as being the only criterion by which the claims of the authors of the "Bridgewater Treatises" to this fund, can be fairly judged of or tried,—should be contingent on something added, or contributed by them, to the departments of science on which they have written. It may, I say, be fairly asked,—where, or in what department, have the authors of these, the Bridgewater Treatises, enlarged the domain of the sciences,—in demonstrating "the power, wisdom, and goodness of God, as manifested in the creation?" Or, on the contrary, and to speak plainly,—can these "Treatises" be justly considered other than as being of that class of *homilies*—certainly most creditable to their authors, and respectable in their line—which have, from time to time, and so frequently, been "both said and sung" on the doctrine of *final causes*. But which, with the exception of recapitulating the discoveries and labours of others in the form of a digest, in illustration of a principle, on which neither doubt or difference of opinion exists,—have, as to them, left these sciences—to use the language of Lord Bacon—"*Vestals;*" or in precisely the same state in which they found them.

Viewing the "Bridgewater Treatises" in this, as I conceive, their true light: and the *mis*-appropria-

* See note, at the bottom of page 426, of the *Edinburgh Review*, for January, 1834.

tion of the "Bridgewater Bequest" by the Committee of the Royal Society, to their production. And, in contrasting the claims of the authors of these "Treatises," whether on the ground of originality or utility,—with those advanced by me, in reference to the present, (which is purely supplementary,) and my former astronomical work, alluded to, —I fearlessly challenge investigation, in thus referring my case to the tribunal of *public opinion.*— A tribunal which—thank God! is still sufficiently powerful, in this country, as—in cases of the kind—to compel attention being paid to its decisions.

As to the gentleman to whom the above paper from me to the Royal Society was, in his official capacity, addressed; and who, as an officer of the society, could only act in conformity with the instructions he received;—I, of course, absolve him from any participation in the affair.

P. M.

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